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The Historic Use of Color in Architecture

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From an illustrated address before the Central Illinois Chapter of the American Institute of Architects

THE genus Homo is endowed with a set of detecting organs by which various environmental facts are sensed and made cognizant to the mind. These intelligences are necessary not only to the preservation of man physically, but also to his delight and satisfaction mentally. I refer to the five means by which man receives stimuli from his environmental world. These we generally call by names that indicate their function —the senses of sight, hearing, smell, touch, and taste.

Tiles. Light and dark blue figures on a salmon-pink background. Blue Mosque, Tabriz, Persia.

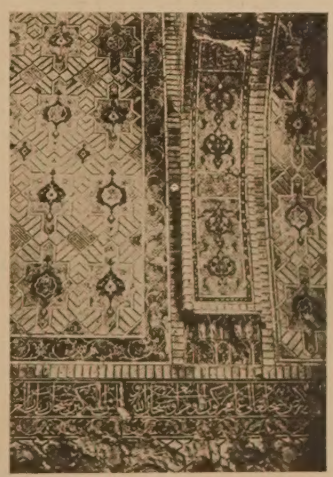
The organs of the first two, the eye and the ear, by virtue of their high state of development, would seem to be the most valuable to mankind. The senses of sight and hearing are usually thought to be of a different order from the other senses. Indeed, the eyes and the ear are called the "true windows of the soul," since they not only telegraph the gathered stimuli immediately to the brain without local or physical reaction, but also deal with stimuli that have to do with man's mental and spiritual delight. I should like, therefore, to direct your attention to a consideration of the stimuli detected by these two organs.

The ear detects simply sound. Man has from time immemorial reacted to sound and very early in the history of the race two "arts of sound," namely literature, the art of the spoken word, and music, the art of abstract, regular sound, made their advent. The eye detects first form, the shape of things, made definite by means of light and shade; secondly, color, and, if you will, thirdly, motion, in so far as motion may be detected by change of position or form. Early in the history of the race the plastic arts, as a means of mental and spiritual satisfaction, had their rise and as a result we have:

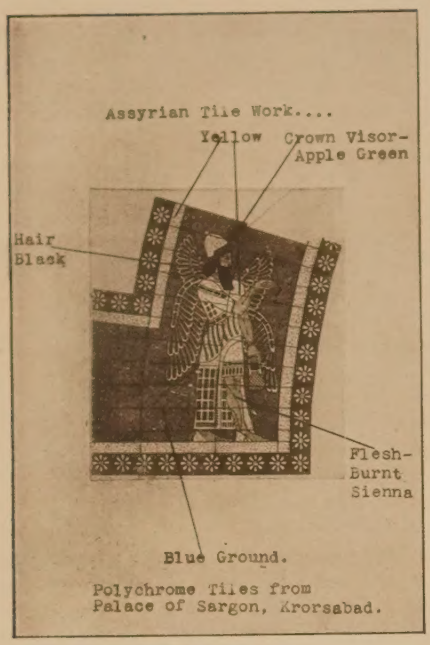
The Art of Form as typified by Sculpture.
The Art of Form as typified by Architecture.
The Art of Color as typified by Painting.
The Art of Motion as typified by the Æsthetic Dance.

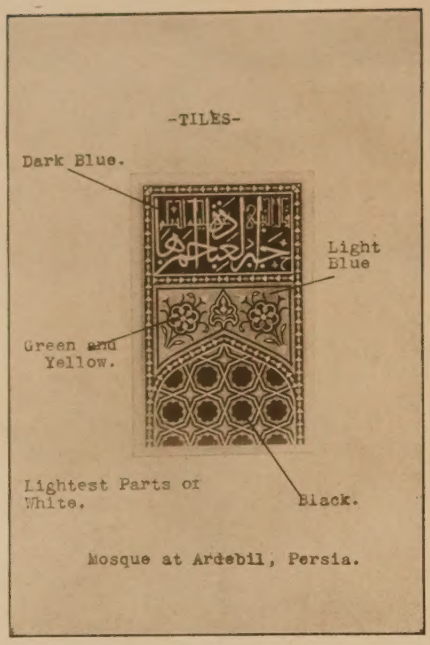
Now, while sculpture and architecture are perhaps considered primarily arts of form at the present time, they have not always been so considered, any more than painting has been or can be considered merely and simply the art of color. In the world of nature form and color are inseparably linked one to the other, and all one has to do to prove this fact is to examine any object in nature. Everything in nature has its color quite as much as it has its form, and why we as a group of designers should think of architecture largely as a colorless art of form, paying little attention to the color possibilities, almost passes understanding. Man has idealized form in architecture and continues increasingly to do so, but insists upon ignoring color, especially so far as the exterior of the building is concerned.

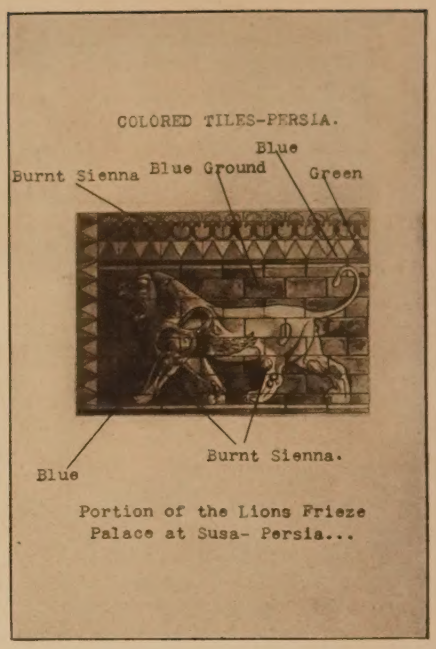
I have tried to account for the apparent depreciation of color and the corresponding worship of form in architecture with no very definite results. Perhaps our present notions are due to precedents that have been set for us a long time ago. In fact, I rather suspect that as far back as the days of the Romans the tendency to accentuate form and neglect color had its beginnings. Viollet-le-Duc has remarked that "the Romans of the Empire seem to have been the first people who erected buildings of white marble or stone without color: as to their stucco work this was always colored whether inside or out." Of course, we know the part that color played in the exterior as well as the interior architecture all during the Middle Ages. With the revival of the classics during the Italian Renaissance, since the Roman was the principal source of inspiration of the designers of that day, color was pretty largely lost sight of, and indeed Palladio, the guiding spirit of the late Renaissance and the man responsible for many of the ideas that eventually filtered into England and through England into our own colonies, may have considerable to answer for in this connection. It



Tiles. Light and dark blue figures on a salmon ground. Blue Mosque, Tabriz, Persia.







was he who proclaimed in defense of his white buildings that "white was more acceptable to the gods." I need not remind my readers of his undoubted influence upon English and consequently upon our own architecture. This fact, coupled with the further sobering influence of Puritanism, not only in the mother country but also in our own land, may account for our extreme timidity in the use of color upon the exteriors of our buildings.

With the introduction of freehand drawing and art study into the American public school, a development that gained its first impetus through the Centennial Exposition of 1876, and the subsequent production of good and cheap water-colors and crayons, we have seen the gradual awakening of a stimulated color appreciation on the part of the general public. During the same time we have witnessed the development of the synthetic dye industry and a marvellous evolution in the arts of color photography and color printing. This has all had its effect upon the popular mind, and all one has to do to convince himself of the fact that an awakened color sense has arrived is to contrast the current costumes of the street with the sober equivalents of his boyhood, or to note the colors of the cars upon the boulevard. What father of ours would have ventured forth in a canary-colored surrey or a maroon phaeton? Pick up any monthly journal and note how color printing achievements appeal to our color sense from almost every page. The public-school book is to-day enhanced with beautiful color illustrations, in great contrast to the sombre woodcuts and zinc etchings of our boyhood days.

And now we hear the cry for more color in architecture, and indeed why not? But architecture being a conservative art always lags behind popular movements. It is now twenty-four years since the first polychrome terra-cotta was used on a shop front at Perth Amboy, New Jersey, but it is very recently that we have seen any insistent attempt to use more color and brighter colors in architecture. The San Francisco Exposition has had perhaps as wide an influence in this direction as any recent event. The execution of that great architectural display in full color and the interest that it generated has had its effect upon American architecture, and although its immediate effects are more noticeable upon the Pacific Coast they are as surely as anything slowly permeating the whole country.

I wonder how many realize that expression in color far antedates man's first attempts at architectural expression at all. In the old cave-dwellings of southwestern Europe, especially in France and Spain, have come to light in recent years simply marvellous wall-paintings executed at a time when the reindeer and the mammoth were extant in that region. These wall decorations, realistic representations of the fauna of the region, were, to be sure, applied to the inner walls of these caves and in that sense were interior decorations, but the point is that they were full color and rather realistic color at that. This proves that primitive man was alive to the color appeal long before he found it necessary to construct a habitation.

It is a commonplace to-day that primitive peoples are keener about color than are their more civilized brothers. Indeed, in our rather colorless immediate past we have seemed to consider a wide use of color rather the badge of barbarism than the mark of culture. How far our tastes have been perverted in this direction, especially in western Europe and America, we are only just beginning to learn.

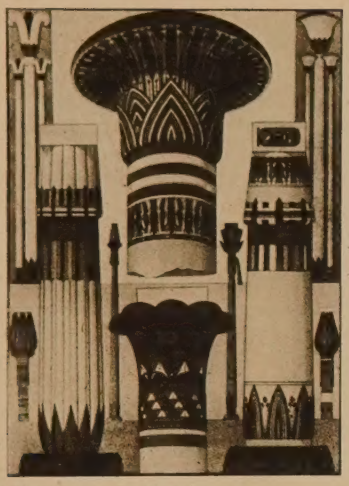
The same love of color that led to expression in the cave-dwelling days of mankind, however, led to a similar expression in architecture as soon as man left the homes provided by nature and began to fashion his own habitation. The story of the use of color in architecture is a long one, but I propose briefly to outline it for you this evening and to illustrate that outline so far as that is possible by means of monochrome illustrations.

Color in architecture is introduced by two different means:

1. It may come in as an intrinsic quality of the structural materials, or

2. It may be applied.

Most of the great styles from the beginning of history down to rather recent days have recognized and made a wise use of color, externally as well as internally. One need only to recall the architecture of the ancient Egyptians, the Persians, the Assyrians, Greeks, Etruscans, Chinese, Japanese, Mexicans, Mayas, Arabs, Moors, and Turks to have passed



Painted ornament. Egyptian columns.

before him in kaleidoscopic fashion a whole series of color impressions. Color is quite as much a part of the racial expression of these peoples as is form, and æsthetically just as necessary and interesting.

Why have all the great styles with the exception of that more or less academic and archæological vogue known as the Renaissance committed themselves to the use of color? Simply because the styles growing, as all architectural expression should, directly out of and in accordance with their environmental background, nature itself, could not separate color and form. Color in architecture was just as natural as color in any other expression because architectural forms were derived directly from nature, and nature everywhere presents color as insistently as it presents form. Art is, after all, only nature plus man's idealism. Architecture is only nature's principles expressed in the concrete, the forms and color of which are likewise only nature's forms and colors conventionalized or idealized. One has only to compare the column with the tree-trunk of the primeval forest, the roof with the eternal water-shedding hills in the landscape about us, the wall with the sheer cliffs that all men encounter some time or another. Man has always seen a relationship between the shelter that he has fashioned and the blue dome of heaven, and nearly every race from the Egyptians down to our own day has insisted upon coloring its ceilings, flat, vaulted, or domical, after the fashion of the sky with a blue field and golden stars.

In Egypt the use and value of color in architecture is apparent in every direction. Everything in Egyptian art was in some way colored. The peculiar Egyptian climate has been called in to explain the predominance of color and the comparatively simple forms. With scarcely any rainfall and with an ever-present, glaring white sun, the reflection of which from the white sands and light loam of the land practically destroys all shadows and nullifies the effect of projections, architectural expression of necessity had to make its appeal largely through the employment of color. Architecture was consequently large in conception, bold in execution, simple in form, but detailed and brilliant in color. Here is a supreme example of the relationship of climate and color in architecture. Every wall, every cornice, column, ceiling, floor was rich with a profusion of varicolored designs. We need not concern ourselves with the subject-matter of these essays, but we do need to realize that every inch (inscription, pictorial story, or symbolical decoration) was illumined in full color.

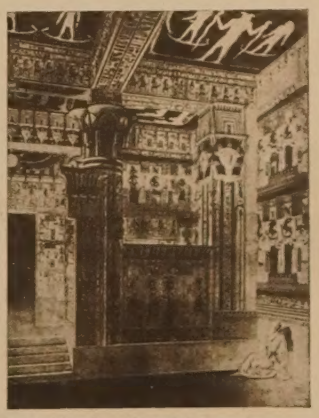
Now, while the peculiar atmospheric effects of Egypt may be held to explain the singular use of color in architecture, it cannot be held entirely responsible for the Egyptian reaction to color in the first place. The Egyptian might have accustomed himself to a comparatively colorless architecture as easily as do our modern city-dwellers. As a matter of fact, however, he lived in the great outdoor climate of Egypt and consequently was far more observant of nature's processes than is the average man of our day. As a consequence he did not develop the use of intrinsically colored materials to any great extent. His color idealism carried him beyond that. To be sure his color idealism may have been bound up with a religious symbolism (and I am of the opinion that it was), but whether it was the custom of the Egyptians to use colors, irrespective of the objects that they represent in nature, as symbols for the conveying of ideas, I have not been able to determine. In coloring his forms he seems to have adhered tenaciously to the colors these same objects presented in nature. The forms and the colors he found in nature, but both were used in a highly abstract and conventional manner.

The color combinations of Egyptian art are as peculiar to Egypt as any phase of Egyptian culture and entirely different from those of any other country. That these combinations became as traditional as did the decorative motifs themselves is entirely plain to one who makes any study of Egyptian art. A characteristic of Egyptian work was the custom of outlining ornamental forms in black or white and of using black bands to separate the reds, blues, greens, and yellows. Another Egyptian peculiarity was the habit of using bright colors upon a white background and thus achieving, by virtue of the dominance of the white, a combination of colors that if used in juxtaposition would have been very unpleasant. In other words, he "drowned" his brilliant, gem-like bits in a "sea" of white just as the Byzantines of a later time drowned their brilliant colors in a "sea" of gold, and the Italian Renaissance workers theirs in a ground of black.

Now while the Egyptians used blues, greens, and black in many combinations, I think that it may be said that the predominant colors of Egyptian work are red, yellow, and white. As a consequence his schemes may be described as warm. Color was used "flat" and not shaded in any way. There was no attempt at depth or perspective, and the walls were treated in a characteristically mural fashion as befits their nature. The Egyptian artist possessed the ability to combine color and low relief in a very intimate relationship without destroying the appeal of either means of decoration, and in this connection modern workers in polychrome terracotta may learn some valuable lessons. The decoration as the Egyptian used it did not, however, increase the architectural value or strengthen the structural lines, and in this sense failed in a respect in which Greek work, as we shall see, excelled.

If the principal colors of the Egyptians were red and yellow, it can be said with equal truth that the arch color of the Mesopotamian peoples (*i. e.*, the Babylonians and Assyrians) was blue. This comparison of dominants gives us the key to the architectural color schemes of the East and West of ancient days. Assyria, Babylonia, and Persia (ancient and modern) used cooler color schemes, while Egypt, Greece, the Roman world, and mediæval peoples used warmer color schemes. Perhaps nowhere has the character of Near Eastern color in architecture been better expressed than in the description of a Persian room in the "Story of the Other Wise Man," by Dr. Henry van Dyke. He says:

"The floor was laid with tiles of dark blue veined with white; pilasters of twisted silver stood out



Painted interior. Egyptian decoration.

against the blue walls; the clearstory of round-arched windows above them was hung with azure silk; the vaulted ceiling was a pavement of sapphires like the body of heaven in its clearness, sown with silver stars. From the four corners of the roof hung four golden magic wheels, called the tongues of the gods. At the eastern end, behind the altar, there were two dark-red pillars of porphyry; above them a lintel of the same stone, on which was carved the figure of a winged archer, with his arrow set to the string and the bow drawn.

"The doorway between the pillars, which opened upon the terrace of the roof, was covered with a heavy curtain of the colour of ripe pomegranate, embroidered with innumerable golden rays shooting upward from the floor. In effect the room was like a quiet, starry night, all azure and silver, flushed in the east with rosy promise of the dawn. It was, as the house of a man should be, an expression of the character and spirit of the master."

This preference for blue goes back in Mesopotamian history a long way and is perhaps best illustrated by the beautiful tiles that were recovered at the site of the palace of Sargon, at Khorsabad, by Victor Place, the French archæologist. The peculiar geological formation of the Tigris-Euphrates basin, since it is alluvial and comparatively young geologically, furnished nothing in the way of building materials except earth. As a consequence ceramic arts had their development here in very remote times, and the Babylonians, Assyrians, and their successors, the Persians, have witnessed the whole evolution of ceramic art from the first mud bricks to the beautiful tiles for which Persia is still known.

Of course, the Assyrian palette was limited by the colors that could be produced in ceramic materials, and as a consequence blues, yellows, and white are by far the most frequent. Grounds are usually blue, figures are in yellow, with flesh tints rendered in burnt sienna, while white and black are used as separators. Occasionally a touch of apple-green is to be seen in the head-dress of a king or a deity. The colors, as in Egypt, were handled in a "flat" way, not graded or shaded, and there was no attempt at representing a succession of planes.

We have noted the fidelity with which the Egyptian artist rendered his subjects in the colors of nature. The Assyrian did not do this. In the case of the animal figures upon the far-famed walls of Babylon some were yellow with white manes and others were yellow with green manes; both combinations, it will be observed, are totally at variance with nature.

Announcements

Carl R. Traner, registered architect, advises us that his address is now 125 Sibley Block, Rochester, N. Y. Gordon, Karlber, and Carl R. Traner are the architects for the new $1,500,000 Baptist Temple Building, Rochester, N. Y., consisting of a large church, auditorium, modern Sunday-school, five stores, and about 450 offices above, including a thirteen-story commercial tower. Drawings are being prepared. They desire up-to-date manufacturers' catalogues and samples.

The H. H. Winner Company, bank architects and engineers, announce the removal of their offices, October 2, 1922, to more suitable quarters, third floor Sharon Building, 55 New Montgomery Street, San Francisco.

Harry C. Child, architectural and structural engineer, has just opened an office in Sayre, Pa., and will be glad to receive general catalogues.

Alfred Bossom was recently in Scotland, where he was for a part of the time the guest of the Forty-second Highlanders, at the headquarters in Perth. He presented the regiment with a record of the work of his restoration at Fort Ticonderoga, N. Y., where the Royal Highlanders covered themselves with glory in 1758. Mr. Bossom invited, on behalf of the Architectural League of New York, the Royal Institute of British Architects to send an exhibition of drawings here for the League's annual exhibition, which takes place early in 1923. Mr. Howard Greenley, president of the League, has just returned from France, where he made a similar arrangement with the French architects. While in London Mr. Bossom was invited to judge the drawings submitted in a competition for a large commercial building, for which a gold medal is to be awarded.

Emilio Levy announces the removal of his office from 331 Madison Avenue to 17 East 49th Street, New York City.

George F. Root, 3d, announces that he has opened offices for the general practice of architecture, at 280 Madison Avenue, corner of 40th Street, New York City.

Resolution Passed by the New York Society of Architects with Reference to Building Superintendents.—After extended discussion a resolution was unanimously passed that the Society make application to the Board of Appeals to adopt a uniform method of procedure for all superintendents of buildings in approving plans by architects and others, independently of any action in granting of building permits. This resolution was passed as expressing the Society's sense of the confusion existing in the various branches of the Building Department, arising in part from the newly adopted requirements of the compensation law.

The *Atlanta Constitution's* issue of September 10, their semi-annual survey of building and business conditions in the South, contained information of a most encouraging kind. The South is evidently prospering in the building field, and the future seems to promise an assured growth of confidence. The survey, prepared by G. L. Miller & Co., shows that a quarter of a billion dollars has been spent in the sixteen Southern States during the first six months of 1922.

Taking the Mystery Out of Home Building.—A model house has been recently completed in Minneapolis, built by the *Minneapolis Journal*, to demonstrate the planning, financing, and building of an approved home at moderate cost. The feature became so popular that as high as 1,200 visitors called at the house in a single day. The home was erected by the *Journal* in collaboration with the Architects' Small House Service Bureau, Northwestern Division, Inc., to take the mystery out of home building and establish confidence in present-day home building costs.

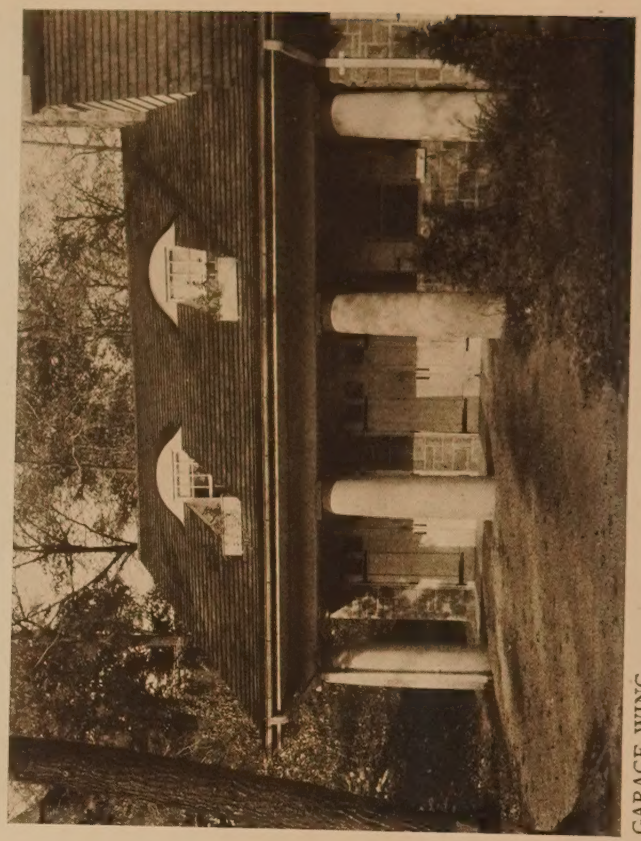
MAIN ENTRANCE.

SUN PORCH.

Dwight James Baum, Architect.

RESIDENCE, CHARLES EVANS, RIVERDALE-ON-HUDSON, N. Y.

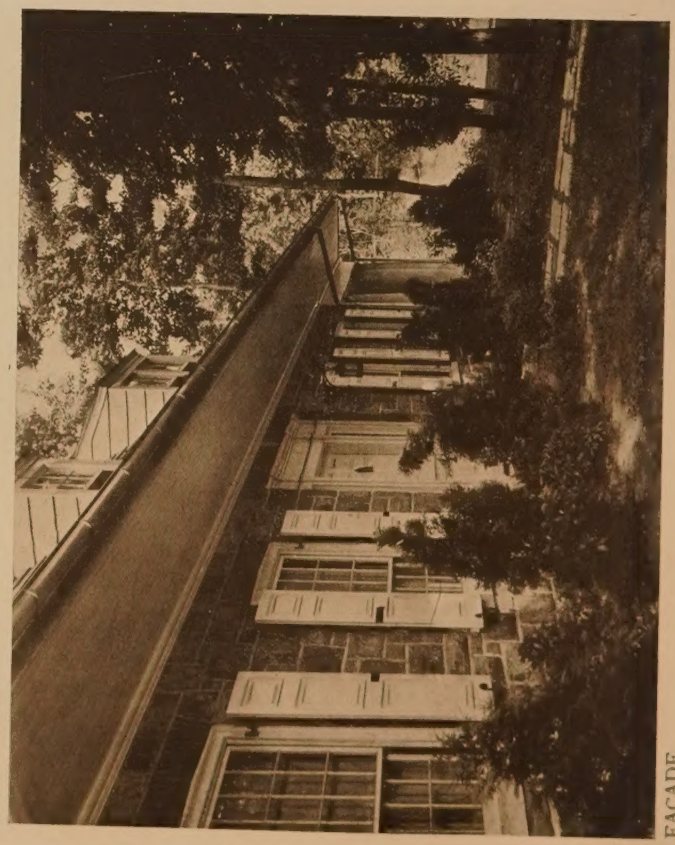
DINING-ROOM.



GARAGE WING.

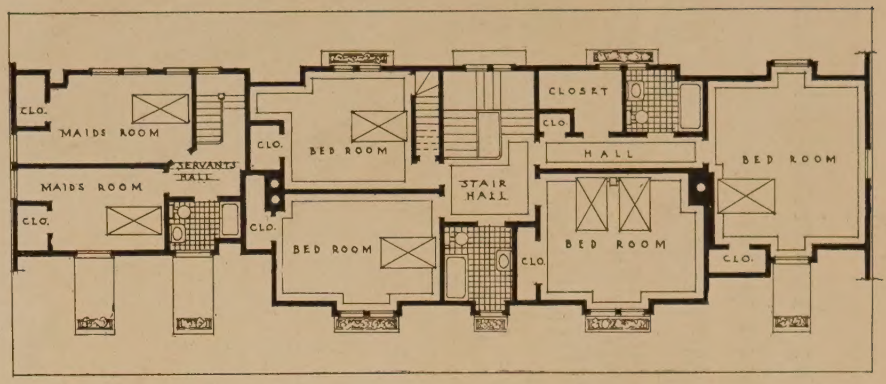
RESIDENCE, CHARLES EVANS, RIVERDALE-ON-HUDSON, N. Y.
Dwight James Baum, Architect.

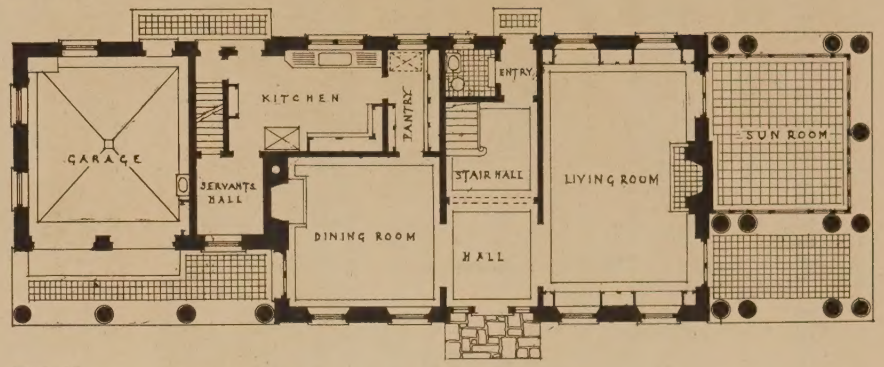
LIVING-ROOM.



FAÇADE.

HALL.





PLANS.

RESIDENCE, CHARLES EVANS, RIVERDALE-ON-HUDSON, N. Y.

Dwight James Baum, Architect.

A Spanish Architect's Impressions of the American Skyscrapers

From an article by Roberto Fernández Balbuena in *Arquitectura*, Organo Oficial de la Sociedad de Arquitectos de Madrid

THE skyscrapers, born of unavoidable necessity as a solution of an economical problem, are themselves the expression of this purpose, and in all present construction a tendency to height is shown.

We are not informed as to the spirit which lifted up the obelisk, the sense of eternity which made the Egyptian pyramids, and there certainly does not exist in the skyscraper the fragrance of supplication that raised the mediæval spires.

The tower of the cathedral was the antenna and the gallery of a population; it was made of stone and expressed the desire of a town to purify itself, reaching above to the cleanliness of the blue.

To-day it is difficult to find in the silhouette of a modern city the mystic voice, for the civic buildings invade all with their massiveness, every day more gigantic, and the towers of churches remain buried among them in silent protest.

New York, in the region about and below the City Hall, is a wilderness of gigantic towers which rise, with brutal audacity born of practical instinct, above the rest of the buildings—museums, libraries, churches, universities, theatres.

New York, van Dyke says, is a city in which many things occur without precedent in the history of humanity. In no other city in the world does the population increase yearly 500,000 inhabitants. In no other city has there been $200,000,000 invested in buildings in one year. Rapidly some avenues have been transformed—Fourth, for example—from a group of old buildings of two or three floors to skyscrapers dedicated to commercial enterprises.

It is difficult in speaking of America in general, of New York, Chicago, Pittsburgh, in particular, to avoid the uninteresting toll of the numbers of millions that are accumulated.

In New York the municipal buildings are formidable, as are the tunnel for bringing the water from the Catskill Mountains, which cost $176,000,000; the one under the Hudson, which takes the subway to New Jersey, the work of McAdoo; the railroad lines which are constructed in improbable places.

The life in a city in which there exist 29,700 factories makes one giddy—in which the trolleys transport annually 452,000,000 passengers, the subways and elevated 2,000,000 daily; in which there is a bridge—the Brooklyn—at a height of 40 metres above the river, 2 kilometres in length, over which 25,000 persons circulate, by which 1,200 trains and 1,200 trolleys pass daily.

The need and special conditions have made New York, so recently born, synthetical in all its crudeness; organized regularly in view of a concrete effort, in which all the exaltations of mechanism, of efficiency, of the positive sense of life, of all the actual aspects, in total, have their expressions carried to an improbable limit. All this seems at first sight to present to us in the light of European civilization the characteristics of American civilization. I believe, however, that the apparent difference is born only of a difference of intensity.

Perhaps the Yankee has the mechanical instinct more developed, that of organization, of commerce. An American professor presented to his countrymen the dilemma that America signifies actual evolution, and concluded it in two invoking words: Carthage or Greece. The positiveness, the commercial spirit, the egoistical restlessness, on one side, and on the other the intellectual life, the beauty, the serenity. In those two words are treated the two forms of civilization possible to-day. Will it be necessary to admit as inevitable the Carthaginian course?

In the lower part of New York the commercial centres are accumulated; so that the whole world looks for a place there; surfaces are rapidly blotted out, acquiring at the same time improbable prices. Floors are added to old buildings, and they go up to six or eight stories, for the tall building is the economical building.

In 1860 the elevator was born; in 1880 hydraulic or steam power. In 1888 commenced the use of the electric elevator, and with the elevator everything began to elevate—buildings, prices, ambitions, hopes.

The older elevations were, however, limited for building reasons; the eight or ten floors of brick, of stone, of marble were heavy and of excessive thicknesses, and the problem was to find a minimum cost, the greatest utility of the areas, the best adaptation—in synthesis, economy, and utility.

Steel and iron are now employed in pillars and supports, and height with quickness of construction is possible. These metallic structures are covered with plates of brick, of stone, of terra-cotta.

The skyscraper is an immense armed beam nailed to the land, and the American architects have baptized the skyscrapers with the name of commercial work. With them has been born, effectively, commercial architecture, and many architects have specialized in this field, made possible, thanks to progress in and evolution of steel, brick, electricity, terra-cotta, heating and ventilating systems, and, above all, elevators.

A skyscraper is a hive of life in which thousands of people work during the day, in which there is an incessant movement of elevators, a continuous use of telephones; in which letters go up by pneumatic tubes to the last floors; in which there is no lack, in one word, of all the elements that contribute to make life somewhat giddy. In those hives are produced those millions of particles of gold which form the gigantic sphere which Gorki sees as an infinite meteor over the city, and which incessantly is pulverized to sustain the feverish activity of millions of beings.

In Chicago the first metallic structures were covered simply with light materials; simplicity being the only preoccupation.

The great merchants of Fifth Avenue, the Gorhams, Tiffany, the banks, wish luxury and style. They push the architects of New York, nearly all of them educated in European schools, to occupy themselves with academic principles of composition, to find beauty in following the criterions of European buildings.

In trying to diminish the sensation of height a system of composition is born and baptized with the name of base, shaft, and capital style.

On Fifth Avenue predominates, therefore, the gloss of the European styles; gloss made by men who have studied to the bottom what Europe did; who have, besides, a firm classical culture. These buildings manifest commercial genius, yet they have none of the merely business appearance, and this tendency signifies a parenthesis in the evolution of the skyscraper and a new type of architecture.

There has been, without doubt, in producing this phenomenon, a perfectly well-explained reason. The American architects have felt the restlessness, in all senses, of the problem of style, and on trying to decide it from traditional—European—standards they have been obliged to shuffle the historical styles to apply them to structures in which the expressive characteristics of the new materials are shown, and have found out the anachronisms which such solutions involved.

McKim, Mead and White initiated in New York the building of a new type; they looked for their inspiration, nevertheless, to the Florentine and Venetian buildings; afterward they leaned to the lessons of Greece and Rome.

Carrère and Hastings developed the correct French custom, and they are the ones that have led the younger generations of architects to the "school of Beaux-Arts." Burnham, Delano, and Aldrich, and perhaps more than any of them Goodhue, are eclectics who make and find solutions in all styles. Perhaps Warren & Wetmore, with their gigantic organization, are the ones who actually give a greater stamp of simplicity and of bareness to their constructions. Cass Gilbert, the author of the Woolworth Building, inspiring as the architecture of the Middle Age, is the creator of the "Commercial Gothic." He obtains with his gloss, in which the size and height lose the superfluous ornamental details, a type which is an example, within its traditional sense, of a modern and audacious character.

But more than they are the Chicago architects, who appear to face the problems of composition, especially in the storage-houses, with all frankness and without school prejudices. And of these Sullivan is the one who gave birth to what Bragdon calls the first American type of real value.

The same preconception of simplicity is seen in the latest buildings in New York.

Is it going, therefore, to stop at an architectural type, exempt from all the expressive traditional elements. Will this type be included in the history of architecture?

Before everything, for those of us who have been educated in the dark of the traditional, is it architecture?

And even supposing that they continue looking to the old styles for the solution of the problem, could we affirm that the works born in that way characterize our epoch and define our style?

Impressions of a New York Architect's Office

Where are the plans of these buildings prepared?

The plans are made in the offices—the French atelier.

One office is on the twentieth floor of a building; the elevator which carried us up to that floor carries some other twenty persons, who tell the boy the number of the floor they wish to get off.

The elevator goes up quickly; the air buzzes in your ears; you feel the giddiness of the height.

We arrive at a light vestibule; on the walls are some pictures, some drawings and plans; decorative plaster; a porter, and a girl in front of the switchboard.

Afterward, an ample room to receive clients, a library, typists, and the work-shop, properly ample, bright, with large, low tables at which thirty, forty, up to ninety, drawing students, architects, engineers of various specialties, work.

Every morning an employee leaves at each place a note marking the work for the day, some photographs, necessary details.

The head designer goes from one side to the other, gives orders, inspects, corrects. The chief appears in the afternoons; carries the directing of all, and at times his voice is heard in the office communicated by telephone.

Constantly the telephones are ringing; some of the students have a telephone instrument on their desk.

The typists work feverishly; perhaps some one, timidly, sings a jovial American song, an old opera air; but there is no noise, there is no loud talking heard; each one, bent over his board, exerts his efficiency, and the hours pass without seeing one another's face.

The work is perfectly distributed. Some execute the façades, others the designs, others the details in the natural size.

The engineers calculate the heating and the ventilation, the statics, distribute the elevators. Behind a counter an employee distributes ink, paper, the elements of work.

All is organized for plentiful and rapid work. In some of the offices the eraser has been adapted to an apparatus very similar to that of the dentists.

The chief architect directs in the fullest sense of the word. He explains the first ideas, corrects these in the interpretations which the assistants present.

In this way all the necessary elements unite in an office to make the finished technical work. By this system a true collaboration is started. It is not absurd to expect from such organizations, at first glimpse, something of the factory—definite and representative fruits.

Modern civilization has complicated life with new organizations; with them has been created the necessity of new buildings, which, if really derived from antecedents of other epochs, are so ideologically separated from them that they may be considered as absolutely new problems.

It was affirmed that until the Renaissance the æsthetical ideal of each epoch showed itself plainly in its temples. In them was buried the constructive problem, and the expression of style found there its definite forms. The temple was the ideal of all the architects.

This ideal with the collective character which it had before can be considered as dead to-day, and if actually, in the temples of the various religions, a considerable effort is displayed, it is not faith that animates them, for in many of them ostentation and the learned preoccupations enter.

All tends to a democratic sense of life, that looks for the convenience of the greater number. The slaves of to-day, the working classes, live in a way never known before.

They speak of the splendors of the pagan life. To-day a laborer of a great population enjoys conveniences which would make the life of our forefathers seem to us repugnant—without light, without the elements which modern hygiene contributes to keep victims from misspent work.

It seems that in the evolution toward democracy we can wait for an ideal beginning, more universal.

GEER MEMORIAL GATEWAY, BARNARD COLLEGE, NEW YORK.

Polhemus & Coffin, Architects.

Editorial and Other Comment

Imported Architecture

IF one should set out to be a critic in general of American architecture, by denying every practitioner access to the past, take all his reference books away together with his magazines, and tell him that the past is past, dead, we are living and thinking only in the present and he must invent new forms expressive of the now, we wonder what the result would be? What would happen if we made the same arrangement with the writers of books, denied them the traditions, the use of the elements of literary style, old standards of language, and demanded that they give us our stories in the polyglot vernacular, say, of a city like New York? We wonder. But there is no gainsaying, as Professor Brander Matthews points out in one of his entertaining and sparkling essays in his book "A Tocsin of Revolt," that there is a painfully disturbing cribbing of things from the past, and too often a shameless attempt to disguise the fact by variations that only emphasize it and make a host of people say that the study of architecture is only a way of finding out where to steal your ideas.

There is a lot of pertinent truth in this:

"Indefensible as is the endeavor to import architecture 'in the original package,' it is not more absurd than the attempt to borrow decoration ready-made. In trying to transplant a French chateau or an English manor-house, there is evident the desire to have at least a dwelling of a single style, however unoriginal it may be; but even more frequent of late in the United States than these homogeneous plagiarisms are the houses whose connecting rooms display a heterogeny of disparate and discordant elements each of them violently swearing at its neighbor. This is what is known as 'period' furnishing and 'period' decoration.

"A room rigidly reproducing the stiff severity of the French Empire will open into another hung with the tapestries and filled with the furniture of the reign of Louis XIV; and this in turn may lead into a third where the decoration is Adam and where the chairs are Chippendale. A Byzantine entrance may conduct the visitor to a Gothic hall on his way to a Louis XVI drawing-room and to a George II dining-room, opening out on a Spanish patio arranged as a conservatory or on an Egyptian tomb forced into service as a billiard-room. The bedrooms may be Japanese or Chinese, Hindu or Persian; and the only American room in the house is likely to be the kitchen—unless perchance the headstrong owner has insisted on making this Pompeian or Assyrian.

"Could anything be less artistic than this inconsistent medley of periods and of places? Could anything be more like an architectural crazy-quilt? Could anything be less homelike? How can anybody ever expect that his household gods will settle down comfortably in so piebald an environment? How can any twentieth century American reconcile himself to taking up his residence in an atmosphere so alien and so unfriendly? How can he feel the warmth of his own hearth when he has condemned himself to dwell in the frigidity of a portfolio of sample-plates? The most that the owner of a dwelling so motley can do is to pride himself on the accuracy of the imitations he has purchased and to be vain over his own absence of originality."

We like to believe that more often than not the architect in such cases is the victim of his client or the client's family, who show him a print from some book or a photograph of something they have seen in their travels, and remark: "I want a house like that." The architect must live, and it is money that talks in these days.

The survival of the past in our contemporary architecture, the use of the classic orders, Gothic details, seems to us, when used with knowledge and good taste, not out of keeping with our right to the heritage of beauty of all the world.

Unfortunately these things are so often but the guinea's stamp, the affectations of a scholarship that fools only the dear public.

We like to remind our readers of the enlightening series of articles that appeared in our pages by Mr. Swartwout on "The Use of the Classic Orders in Architecture."

To revert to Professor Matthews, we hope he may live to realize his dream, and may we dream with him:

"We have all of us our day-dreams; and it is one of mine that if I were a multi-millionaire, still in the prime of life and fortunate in a wife who was a helpmate and in half-a-dozen sons and daughters who might gather about the hearth of an evening, I would build a house for myself that should be truly a home, 'adapted to its occupants,' made for us and for no one else, fit for a family to grow up in and to leave with regret and to return to with unfailing joy. Moreover, it should be a dwelling at once contemporary and American, with nothing antique or imitated, and with nothing alien or exotic. It should be the product of America to-day, a genuine effort to represent our country and our time, an expression of the very best that an American architect could do with the aid of the foremost of our painters and sculptors.

"If the house of my day-dream could be completed according to this principle, it would be as absolutely native to us now as an Italian palace of the Renascence was to its owner; and it would be as spontaneous an outgrowth of our contemporary civilization as was a chateau on the Loire or as a Tudor manor-house, each in its own time and place. Its designer would not be thinking of his 'style'; and he would not be straining himself in quest of overt originality, any more than did the designers of the palace, the chateau, or the manor-house.

The Modern Hospital

WE recently announced the offer of prizes by the Modern Hospital Publishing Co., for designs for a small hospital, and we hope that when they are built they will take into consideration the innovations made by the new Fifth Avenue Hospital in New York. When doctors disagree there is hope for the patient, they say, and when the builders of hospitals realize what the psychologists have long realized, that color may play an important part in the state of mind, we shall start patients on their journey through a serious illness or dangerous operation in an environment that looks less like a morgue than the average hospital room or operating-room of to-day. Of course, everything must be immaculately clean, but apparently this may be achieved and yet some vestiges of home comfort left.

The walls of the rooms of the Fifth Avenue Hospital are "in French gray, buff, or tan, with dainty, pleasing furniture." And here is a picture of the operating-room:

"Even the patient who is about to undergo an operation is considered in the furnishings. Instead of being wheeled into a huge bare room, where there is nothing but an extra stretcher or two to distract her attention from her own pain and apprehension, until the anæsthetist has done his work, the patient at the Fifth Avenue Hospital is taken to an anæsthetizing room which resembles a small parlor. In place of iron enamelled furniture sparse in quantity and utterly devoid of beauty, with which most anæsthetizing rooms are equipped, these little parlors are attractively furnished with wooden furniture and—in utter defiance of the old bare hospital tradition—they have rugs on the floors and curtains at the windows."

Planning the Philadelphia Sesqui-Centennial

Doctor Philippe Cret and E. B. Temple Are to Take Charge of the Preliminary Work of the Planning of the Philadelphia Sesqui-Centennial Exhibition.

ON recommendation of the Engineers' Club of Philadelphia and the Philadelphia Chapter of the American Institute of Architects, Doctor Paul Philippe Cret and Mr. E. B. Temple have been designated as architect and engineer, respectively, to take charge of the preliminary planning of the Sesqui-Centennial Exhibition, to be held in Philadelphia in 1926, in celebration of the one hundred and fiftieth anniversary of the signing of the Declaration of Independence. In explaining the action of the Committee on Grounds and Buildings, headed by General Atterbury of the Pennsylvania Railroad, Colonel Franklin D'Olier, President of the Association, said: "The purpose of this move is to work out a tentative plan of grounds and buildings on the Parkway-Fairmount Park Site. Mr. Temple, in consultation with the Engineers' Committee, and Doctor Cret, in consultation with the Architects' Committee, and also with the approval of our Association, will select their associate engineers and architects. They will form a small, compact, rapidly working group of engineers and architects who will submit this plan at the earliest possible moment. Doctor Cret and Mr. Temple have volunteered their services as a matter of civic pride, and will act without compensation for this preliminary work." Mr. E. B. Temple is assistant chief engineer of the Pennsylvania Railway System, which position he held since 1906. He has been with the Pennsylvania since 1901, when he graduated as an engineer from Swarthmore, in the same class with Governor Sproul. He is fifty years of age, a member of the American Society of Civil Engineers, American Railway Engineering Association, the Engineers' Club of Philadelphia. He is also serving, by appointment of the governor, on the Pennsylvania State Art Commission. Doctor Paul Philippe Cret is well known as the professor of design in the School of Fine Arts in the University of Pennslyvania, to which he was called in 1903. He is a native of Lyons, France, where he was born in 1876, a graduate of the Ecole des Beaux-Arts of Lyons and also of the Ecole des Beaux-Arts of Paris, and the recipient of numerous prizes and honors in the French salons. His best-known architectural works in this country are the Pan-American Building in Washington and the Public Library at Indianapolis.

Le Brun Scholarship

THE Le Brun Scholarship Committee of the New York Chapter A. I. A., Julian Clarence Levi, chairman, announces the holding of a competition for the award of this scholarship for the year 1923. The application and nomination blanks can be had of the secretary of the various chapters A. I. A., or of the Le Brun Scholarship Committee, New York Chapter, A. I. A., 215 West 57th Street. The programme will be issued the end of December, and the competition drawings will be judged about March 1, 1923.

Stabilization in Industry Reflected in Fewer Accidents

THE frequency of accidents among shop employees has shown a considerable decrease, due to the stabilization in industry brought about by the present economic conditions, according to Mr. A. E. Kidd, Employment Manager of the Western Electric Company at New York. It is very probable that this condition is due to the presence of operators and mechanics of longer experience on the job.

"Employees are less restive to-day and are not moving around from job to job," he states. "The fact that many industrial organizations are releasing their employees has caused those who have jobs to hold on to them. The evidences that we see in the applicants for positions show that industrial organizations are releasing the inefficient workers.

"There is an increase in the volume of applicants, but the quality of the applicants is decidedly low. Most of those who appear at the employment office to-day are out of employment. We see very little of the type who formerly sought other positions for a change of environment or for financial improvement. The greatest surplus of workers to-day appears to exist among the unskilled mechanics or those who operate one type of machine."

In the vicinity of New York for the past few years there was great scarcity of young men to do office work of the character usually described as messenger work. These, however, are now appearing in some numbers, so that it is evident that the factories are not absorbing as many of the younger men as they formerly did.

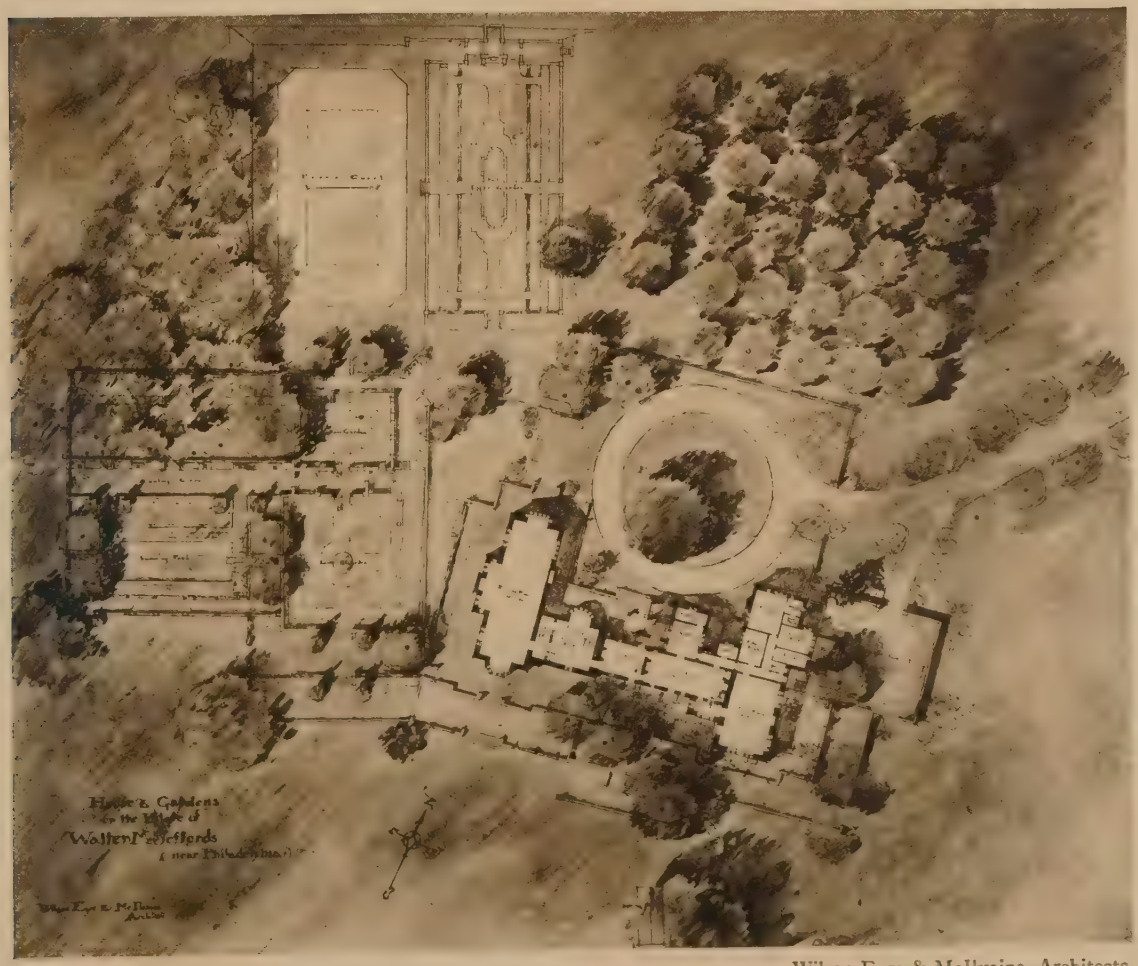
The Western Electric Company is now employing the largest personnel in its fifty-one years of existence.

"HUNTING HILL FARM," WALTER M. JEFFORDS, NEAR MEDIA, PA. Wilson Eyre & McIlvaine, Architects.

"HUNTING HILL FARM," WALTER M. JEFFORDS, NEAR MEDIA, PA.

Wilson Eyre & McIlvaine, Architects.

ENTRANCE COURT.



PLOT PLAN.

Wilson Eyre & McIlvaine, Architects.

"HUNTING HILL FARM," WALTER M. JEFFORDS, NEAR MEDIA, PA.

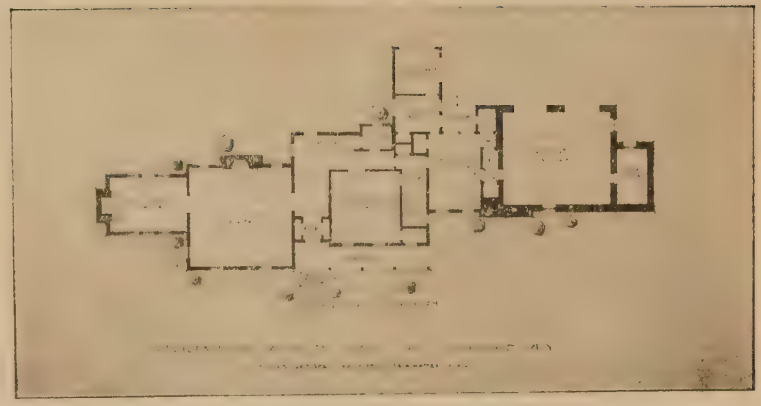
ENTRANCE FRONT.

GARDEN.

RESIDENCE, ALLEN TOBEY, SCARSDALE, N. Y.

Julius Gregory, Architect.

DETAIL OF FRONT.



RESIDENCE, ALLEN TOBEY, SCARSDALE, N. Y.

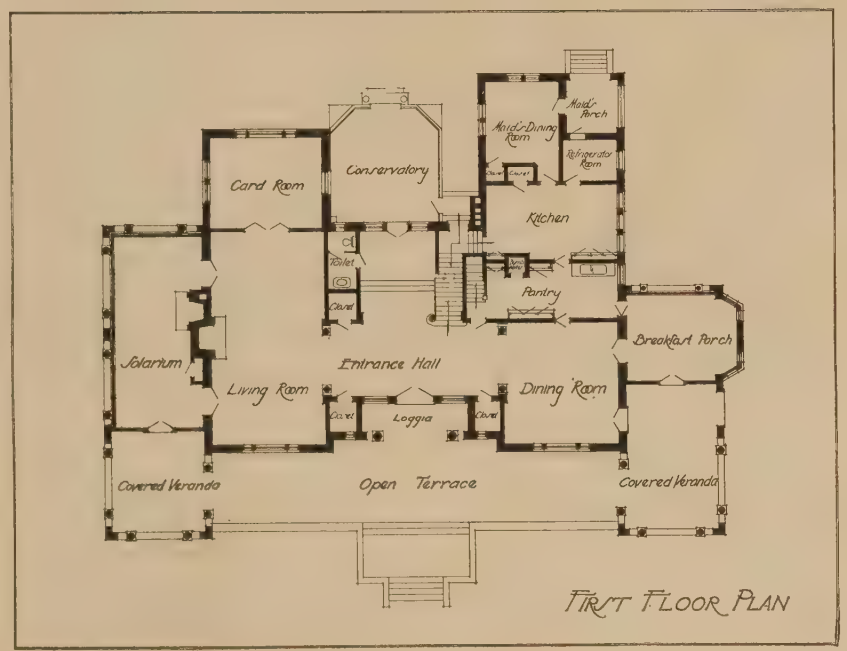
Julius Gregory, Architect.

RESIDENCE, JOHN W. McDONALD, DEAL, N. J.

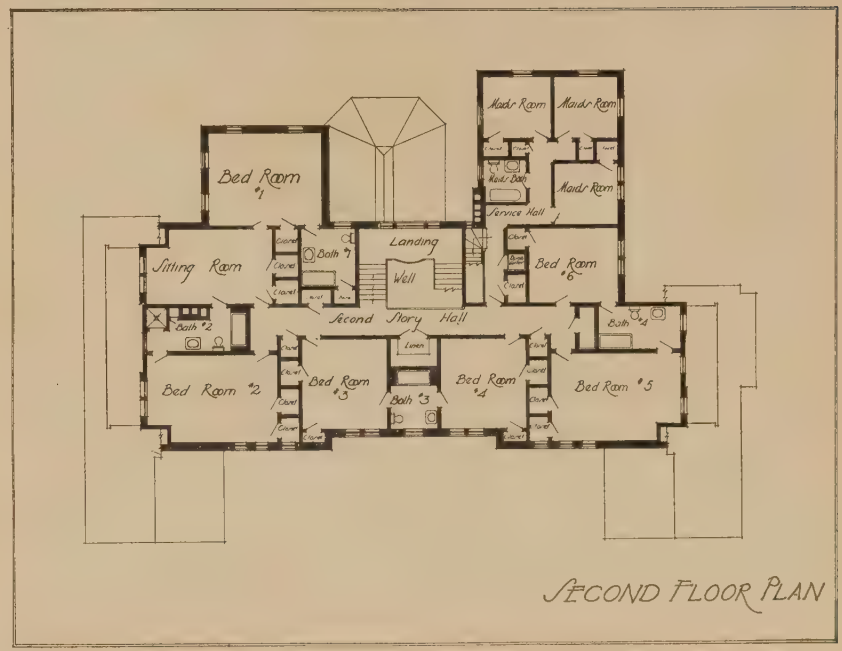
K. MacM. Towner, Architect.

LIVING–ROOM.

BREAKFAST–ROOM.



RESIDENCE, JOHN W. McDONALD, DEAL, N. J.



K. MacM. Towner, Architect.

HALL AND STAIRCASE.

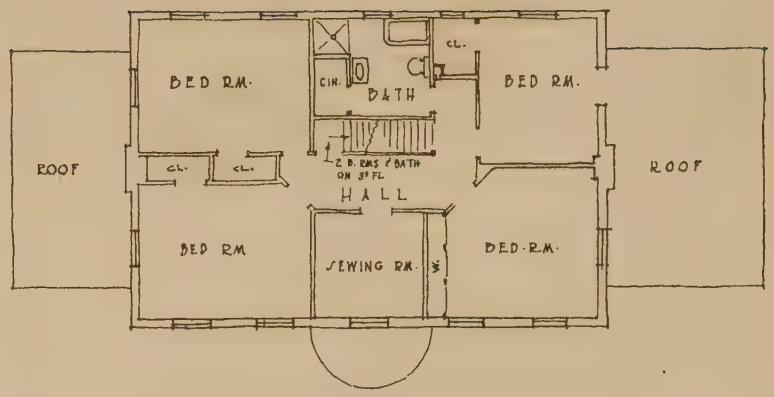
VIEW THROUGH FIRST FLOOR.

RESIDENCE, JOHN W. McDONALD, DEAL, N. J.

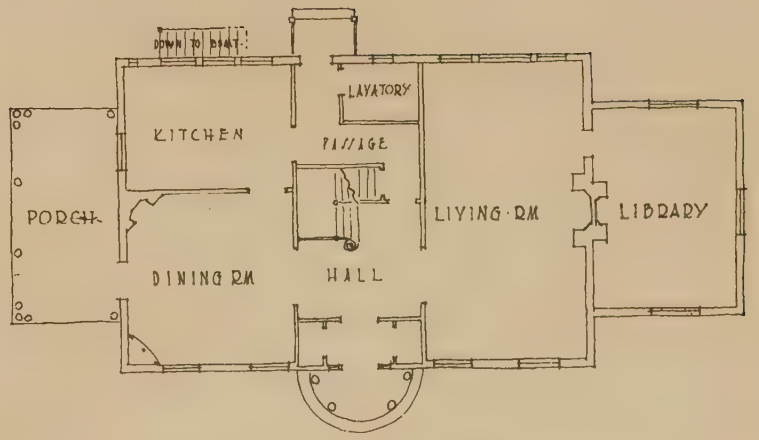
K. MacM. Towner, Architect.

HOUSE, W. J. CAMERON, DEARBORN, MICH. Albert Wood, Architect.

ENTRANCE, HOUSE, W. J. CAMERON, DEARBORN, MICH.

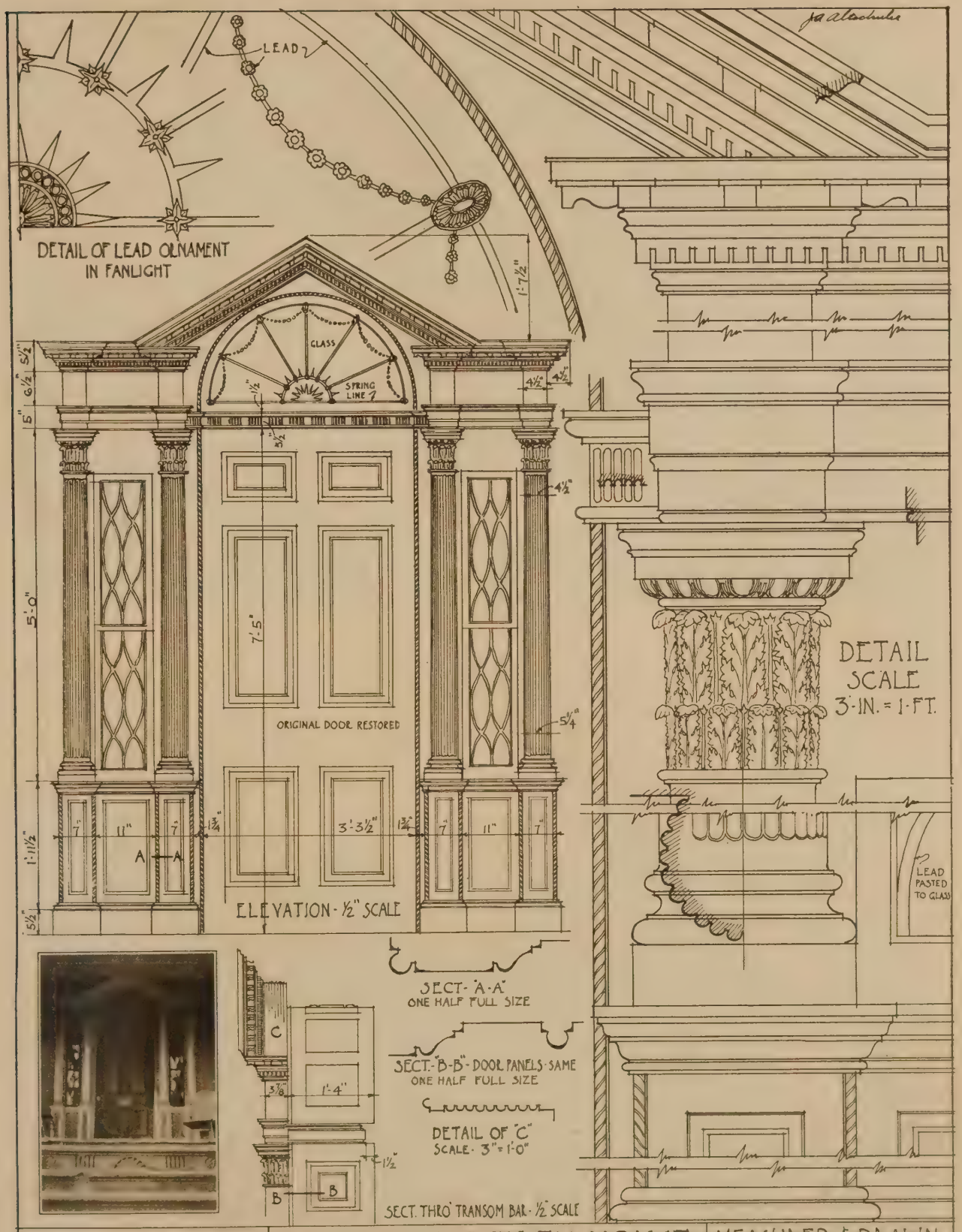


SECOND FLOOR.



FIRST FLOOR PLAN

Albert Wood, Architect.

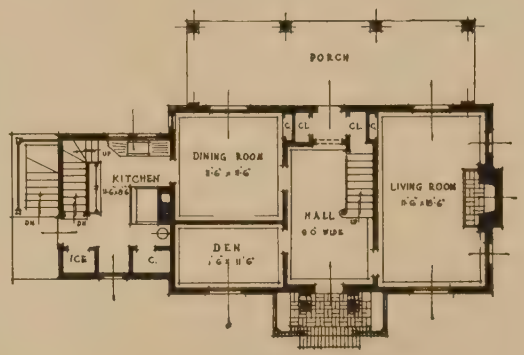


COLONIAL ARCHITECTURE of the CAROLINAS	DOORWAY - WELEM HOUSE DATE - ABOUT - 1760 CHARLESTON - S.C.	MEASURED & DRAWN by J. A. ALTSCHULER

REAR OF HOUSE.

FRONT OF HOUSE, THOMAS W. WHITALL, KATONAH, N. Y. Polhemus, Mackenzie & Coffin, Architects.

DETAIL, HOUSE, THOS. W. WHITALL, KATONAH, N. Y.



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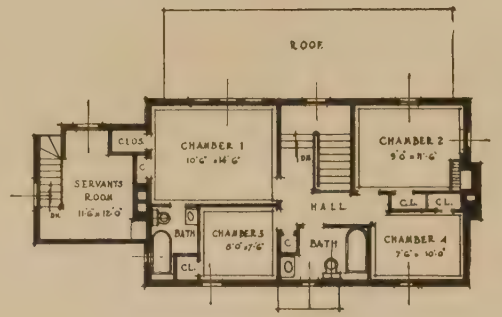


SECOND FLOOR PLAN

SCALE 1/8"=1'-0"

HOUSE FOR
MR. & MRS. THOS. W. WHITALL
KATONAH N.Y.

POLHEMUS MACKENZIE & COFFIN
ARCHITECTS
15 EAST 40 TH ST. N. Y. C.

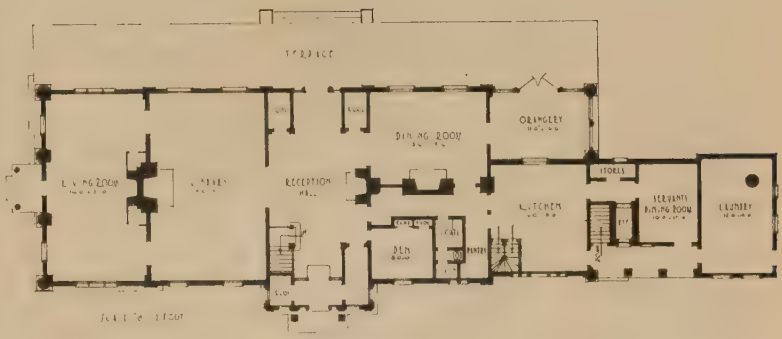
Polhemus, Mackenzie & Coffin, Architects.

RESIDENCE, HOWARD BAYNE, MORRISTOWN, N. J.

Alfred C. Bossom, Architect.

VIEW THROUGH FIRST FLOOR.

SECOND FLOOR PLAN



FIRST FLOOR PLAN

RESIDENCE OF HOWARD BAYNE ESQ
MORRISTOWN NEW JERSEY

ALFRED C. BOSSOM
ARCHITECT
680 FIFTH AVENUE

RESIDENCE, HOWARD BAYNE, MORRISTOWN, N. J.

Alfred C. Bossom, Architect.

Living-room, residence Howard Bayne, Morristown, N. J.

Book Reviews

ARCHITECTURAL DRAWING. By W. B. Field, Assistant Professor of Engineering Drawing, Ohio State University, with an introduction and an article on lettering by Thomas E. French, Professor of Engineering Drawing, Ohio State University. 161 pages, 9 by 12, 79 plates. $4.00. McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York.

The author has had experience both as a practising architect and a teacher of drawing, and has brought together those fundamental subjects in drawing that should be studied by the prospective architectural draftsman and architect, putting them in such form that they may be at hand for ready reference as he works over his designs on the board. It is therefore a text-book and a reference book.

Contents: Introduction. I.—Graphic Methods of Representation. II.—Drawing Instruments and Their Use. III.—Geometric Methods. IV.—Preliminary Sketches. V.—Scale Drawings. VI.—Detail Drawings. VII.—The Orders of Architecture. VIII.—The Acanthus Leaf. IX.—Mouldings. X.—Architectural Lettering.

SKETCHING AND RENDERING IN PENCIL. By Arthur L. Guptill. With a Preface by Howard Geenly, A. I. A. The Pencil Points Library, Eugene Clute, Editor The Pencil Points Press, New York.

We are glad to say welcome to so good a book as this, so useful a book and one so comprehensive. There isn't much literature on the subject, and nothing that we know quite as representative and of such especial value to the architectural draftsman. But it is a book that should be useful as a text-book in schools of drawing and to art students of all kinds. The pencil is such a beautiful and readily available medium, and can be made to be so expressive in the hands of a skilful and knowing worker. The book is the outcome of a series of lectures delivered at Pratt Institute. There are numerous illustrations by the author and by others. The chapter on "Sketching Animals" is illustrated by Charles Livingston Bull, whose admirable drawings are known to all.

NORTHERN ITALIAN DETAILS, DRAWINGS AND PHOTOGRAPHS. By Walter G. Thomas and John Fallon. With an Introduction by John Mead Howells. U. P. C. Book Co., New York.

These 143 plates, which have previously appeared in the *American Architect*, make a portfolio of great value as a reference.

Mr. Howells has expressed the practical service of these details in his admirable introduction:

"These fully developed details were often worked from finished architects' drawings, such as we produce to-day, and so we now come to the reverse problem, three hundred years later, of how to get these fine details back into the hands and heads of our present architects and draftsmen. The method used in this collection seems the direct and practical one—*i. e.*, that of giving photographs and measured drawings of the same detail side by side. The photograph gives the sentiment and impression of the original detail, and the drawing gives the means of reproducing it exactly. I think for our architectural health just now in America an exact reproduction of a good detail is usually better, both for the architect and for the public, than a denatured or 'improved' reproduction."

INDICATION IN ARCHITECTURAL DESIGN. A Natural Method of Studying Architectural Design with the Help of Indication as a Means of Analysis. By David Varon, Architect Diplôme, Ecole des Beaux-Arts. Second edition enlarged. William T. Comstock Co., New York.

Professor Varon's book has been for a long time a valued and stimulating book for the student, and he has added new material that increases its usefulness.

FORM IN CIVILIZATION—COLLECTED PAPERS ON ART AND LABOUR. By W. R. Lethaby. Oxford University Press (American Branch).

We wish every architect in the country could read the essays contained in this little book. They would do a lot of good and set many on the road that leads to sanity in thought and expression, and above all to sound and well-reasoned work. "The Architecture of Adventure," "Architecture and Modern Life," "Education of the Architect," "What Shall We Call Beautiful?" are some of the topics, and in all of them is to be found something to be remembered.

Some of our readers will recall Mr. Lethaby's admirable volume on "Mediæval Art from the Peace of the Church to the Eve of the Renaissance."

The Architecture of Robert and James Adam

Robert Adam, Wedgwood Cameo. Modelled by Tassin.

THE ARCHITECTURE OF ROBERT AND JAMES ADAM (1758–1794). By Arthur T. Bolton, F.S.A., F.R.I., B.A. (Curator of the Sir John Soane Museum). Containing About 700 Superb Illustrations, Plans, and Drawings. 2 vols. Large Folio. Charles Scribner's Sons, Publishers, New York.

"It is the fate of the distinguished house architect that very little should be known of his finest work." How true this is in regard to distinguished architects of our own time is only too evident, and but for the showing of their current work in our architectural magazines, few indeed would ever know the names of the designers of some of our most distinguished and beautiful residences. And, in our residential work, we are leading all the world, both in plan and design.

It was fortunate for the Adam brothers that their interests and manifestations were so varied, that they won fame not only for their buildings but quite as much so for their work in the decorative arts associated with their architecture. Robert Adam, the more distinguished and many-sided of the brothers, derived his training from an intensive study of the Italian Renaissance, and all his tendencies were toward a greater refinement and a departure to more vigorous and individual work of his great predecessors, Sir Christopher Wren and Inigo Jones.

No architect ever had a greater vogue among the wealthy and fashionable society of his day, and none has left behind a more enduring tradition, a more vital lesson for succeeding generations. The story of his life and of the brothers Adam is a story of the development of a new era in design, and of the part played in a successful career by the cultivation of the social graces.

The author of this fine book says: "It is certain that Robert Adam's place can only be alongside Inigo Jones, Sir Christopher Wren, Sir John Vanbrugh, and Sir Charles Barry."

This seems a fair placement in some ways; certainly in point of world fame Adam might even be put at the head of the list. But, with all his distinction, there will remain in the minds of many of his students the thought that, with all his wonderful versatility and adaptiveness, he missed the distinction that we associate with the vigor and boldness of Jones and Wren. He added tremendously to the development of luxuriant living, to the ornamentation and elegance of houses of the rich, and raised at the same time the standards of design in all things that go to the making of a house in which was manifest the wish, at least, to be surrounded by the evidences of culture and elegant taste.

There has been no book published heretofore that gives such a complete history of all the Adam enterprises, including the great speculative development and fiasco of the famous Adelphi Terrace—one of the biggest real-estate operations recorded in the life of any architect. The author has had unusual facilities in his connection with the great Soane Museum. He thoroughly examined the thousands of drawings that are housed there, heretofore but little known, and has had access to many records that have either been ignored or overlooked. A careful attempt has been made to give authentic records of all of the Adam houses and to separate from them those of doubtful attribution.

The book becomes something besides a mere record of the Adam brothers, for its complete record of their work necessarily goes into the history of houses they built and of their clients. In reading the career of Robert Adam, you read of the man with whom he was associated in his work, and you read, of course, of the enmities he made, of the petty jealousies and criticisms that are the inevitable concomitants of any successful career. Horace Walpole, one of the famous art dilettanti of the times, a supposed authority in social circles in about everything that concerned good taste, had his fling at Adam.

But no criticism could really make much difference with the success of so able a d signer, one with so much refinement of expression, such an admirably restrained sense of good design and ornament, and such a successful cultivator of wealthy and influential clients. We might almost summarize the essence of Adam's claims to distinction by saying that he was, above all, a master of those elements that we associate with the word "elegance."

These two sumptuous volumes with their profuse and beautifully printed illustrations that include a complete survey of the architecture, decoration, and furniture of the famous Adelphi Brethren, constitute not only a monument to them, but an encyclopædic reference for all concerned in architecture and the decorative arts.

Many architects will be interested in the quotations from Adam's own writings that give some of the principles upon which he made his designs.

The following is his comment on ceilings and wall decorations:

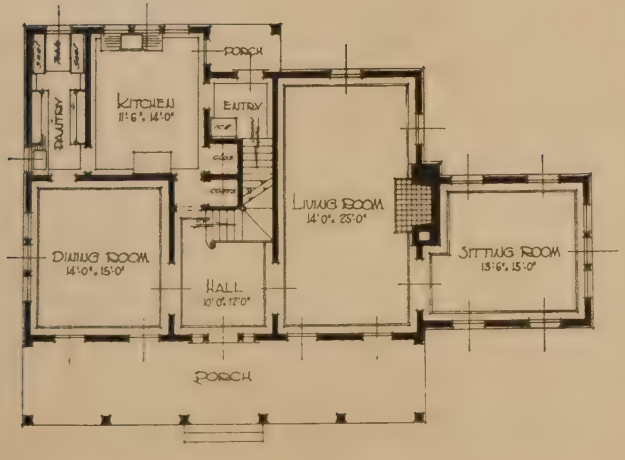
"These absurd compositions (*i. e.*, the vast internal entablatures and cofferings of soffits) took their rise in Italy, under the first of their modern masters, who were no doubt led into that idea from the observations of the soffits used by the ancients in the porticos of their temples and other public works. These the ancients, with their usual skill and judgment, kept of a bold and massive style, suiting them to the strength, magnitude, and height of the building, and making an allowance for their being on the exterior part, and adjoining to other great objects: all which served to diminish and lighten the effect of these compartments. But on the inside of their edifices the ancients were extremely careful to proportion both the size and the depth of their compartments and panels, to the distance from the eye and the objects with which they were to be compared: and, with regard to the decoration of their private and bathing apartments, they were all delicacy, gaiety, grace, and beauty. If the reader is desirous to examine more minutely into these truths, let him consult the Rotunda, the Temple of Peace, the ruins of Adrian's villa, the Palace of the Emperors, and other Cryptæ at Rome, with the inimitable remains on the Baian shore. We shall only add, that from this mistake of the first modern Italian artists, all Europe has been misled, and has been servilely groaning under this load for these three centuries past."

That he was a thoughtful and conscientious student of the great period of the Renaissance is evident, and he had the courage of his convictions in being ready to depart from exact forms to adapt the things he studied to agree with his own ideas of design. His was a catholic taste, and his success, taking his work by and large, was phenomenal.

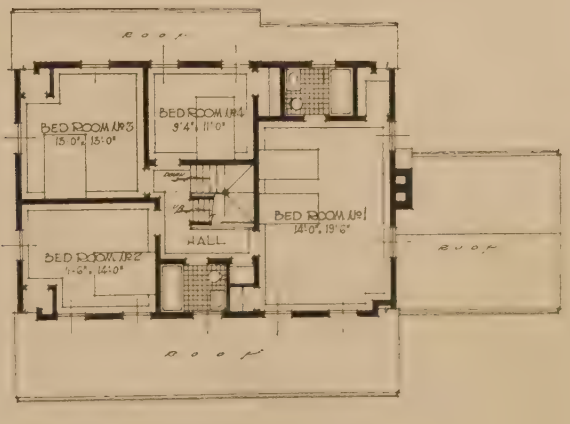
That the Adam influence is still very much alive needs no saying. In New York one may study his characteristic details in many buildings, but especially in the great Vanderbilt Hotel on Park Avenue. We wonder, though, how many of the thousands who pass it or enjoy its hospitality in the course of a year are even aware that Robert Adam ever existed.

We cannot refrain from expressing the thought that in our own Stanford White we had a man who, in his day, was remindful of the career of Robert Adam. He had the versatility, the adaptability, the genius of good taste, the fine sense of proportion that were the essential qualities of his English predecessor.

Detail of drawing-room ceiling, David Garrick's house, No. 3 Adelphi Terrace.



FIRST FLOOR PLAN



SECOND FLOOR PLAN

HOUSE, FREDERICK COOKE, TENAFLY, N. J.

R. C. Hunter & Brother, Architects.

Construction of the Small House

By H. Vandervoort Walsh
Instructor, Columbia University Architectural School

ARTICLE XXIII

Financing the Construction Work

THE problem of financing the small house is a part of the problem of building and to some extent is a very personal affair, and every prospective owner has his own difficulties and personal solutions. Those who have saved for a number of years enough money to invest in this adventure of home-building are quite simply fixed, and all that they need consider is how large a house they can have for the money saved.

A method was shown in the beginning by which the approximate cost of a house could be determined when the plans were in the rough. This consisted of studying the houses built in the neighborhood where the new home was to be erected, calculating their cubical contents and dividing this into their total cost, so that their cost per cubic foot could be known. By comparing this result with the figures which the local builders had offered, a fair idea could be obtained of how much per cubic foot the new house would run. A few figures were given for the different types of construction, but nothing certain can be predicted from them, for, as was pointed out, the cost is definitely related to the locality and the time.

Once, however, having arrived at a reasonably correct cost figure for the cubic foot, the question of how big a house is to be had for the money is quickly determined. Divide this cost per cubic foot into the total sum of money which is to be used for building the house, and the allowable number of cubic feet in the new house will be found. If now the average height of the new house, from the cellar to the average height of the roof, is divided into this allowable cubic contents, the allowable ground area for the plan will be known.

For example, suppose the sum that can be invested in the house itself is $10,000, and it is found that the houses in the locality, of similar construction, cost per cubic foot about 35 cents. Dividing 35 cents into $10,000, it is found that a house having approximately 28,570 cubic feet can be constructed. If 8 feet is allowed from cellar floor to level of first floor, 9 feet from first to second floor, and 13 feet from second floor to the average height of the roof, then a total average height for the house will be found to be 30 feet. Dividing this 30 feet into 28,570 cubic feet, it will be found that a floor area of approximately 950 square feet can be had. Now as the floor area of the plan of any two-story house is determined by the area required for the second floor and not the first, the desired sizes of the various bedrooms should be approximated, and the results added together to see whether they come within the allowable floor area. Continuing this example, suppose that the master bedroom is to be approximately 14 feet by 15 feet, the other three bedrooms approximately 12 feet by 12 feet, the toilet about 7 feet by 10 feet, the hall about 8 feet by 12 feet, then by adding the area of these rooms together it will be quickly found out whether the allowable area has been exceeded.

Master bedroom, 14 feet by 15 feet	210 square feet
Three other bedrooms, 12 feet by 12 feet	432 " "
Toilet, 7 feet by 10 feet	70 " "
Hall, 8 feet by 12 feet	96 " "
Total	808 square feet

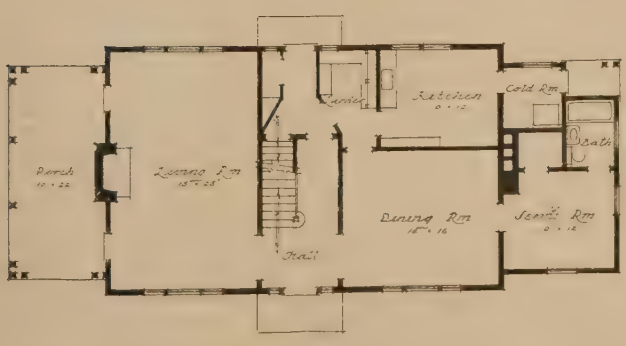
This number of square feet is within the amount allowed, which is 950, but additional area must be added to this for closets, say 3 feet by 4 feet for the closet of the master bedroom, and 3 feet by 3 feet for the closets of the other rooms, and other closets for linen and space for chimneys and the like, making about 60 square feet which should be left for this part of the plan. This makes the area about 868 square feet, and no allowance has been made for porches or passageways. It is quite evident from this that the number of bedrooms desired, their approximate size, and the size of the toilet and closets is nearly up to the maximum which the limitations of cost will permit. Working with these approximate figures, the plans of the house can be roughly prepared, the area required for the second-floor rooms being used as a basis for the allowable area of the first floor, since it is more than enough, for the second-floor area of a house, as has been said, is always greater than the minimum area for the first floor.

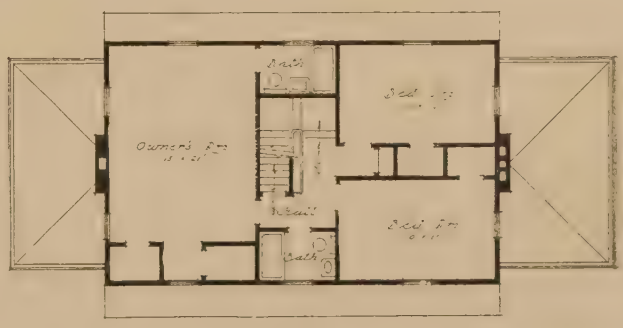
When roughly prepared plans and elevations have been arranged on this basis, the cubage can again be checked, and if it is over the allowed amount, the size should be cut down; if under, increased. The cubical contents of porches may be computed at one-quarter of the cubage of the main portion of the house, but if enclosed with glass they should be estimated at their full cubic contents.

Having thus roughly arrived at the plans and elevations of the house which is within the allowed cubage, a rough outline specification should be prepared in which the essential materials, workmanship, and mechanical equipment are defined. Enough information will then be had from which a rough estimate can be secured from a local contractor, or even the architect may make an estimate, based upon previous examples of other houses. If this rough estimate comes within the allowable figure which is to be spent for construction, then the contract drawings can be safely started, and a reasonable assurance can be had that the cost of the house will not go beyond the amount of money available. As most contractors will give an outside price on any preliminary estimates of this kind, unless radical changes are made in the plans, it can almost surely be the case that the final estimate on the contract documents will be less. However, there are often times when the final figures exceed these preliminary estimates, and one should always be prepared to shrink parts of the building or withdraw some of the finest requirements of the specifications.

But one of the prime essentials in financing any building operation is to be sure that the contract drawings contain everything which is desired in the finished building, and that none or very few changes are made in the building after the contract is let and the building is in process of construction. Alterations from the original plans, after construction work has begun, come under the bugbear title for all architects, "Extras." They always mean waste of money. Likewise, things which were omitted from the plans and specifications, which are later found to be necessary, run up extraordinary bills, and the general impression which most people have that a building operation always costs more in the end than was originally counted upon is due largely to the neglect of these factors. Competent architects make

(*Continued on page 346*)





HOUSE, HARRY W. ROBERTS, UTICA, N. Y.

Bagg & Newkirk, Architects.

(*Continued from page 344*)

such complete plans and specifications, that extras of the "omission type" are avoided, but most small houses are built from plans that are not complete, or prepared by architects who sell their services at such low rates that they cannot afford to take the time to check up the plans carefully. It is right here that the architect has a real business point to give the client, namely, that if he does not pay for carefully prepared plans and specifications in the beginning, he will pay out much more in the end for extras.

Up to this point the financing of the small house, for the one who has the money, is not complicated, but this is the unusual condition, because the average person who builds the small house has not the ready cash to put into it, for that is the reason he builds a small house. The average individual who builds the small house generally has a certain amount which can be invested and the rest must be borrowed, and there are many who advise that even if one did have the whole amount to invest, it would be better to borrow some for the building operation, and keep out as much as possible for investments in other lines where the money might bring in greater returns.

The problem naturally turns upon where and how much can be borrowed for the building operation. Here again a very personal matter is involved. Some will have very close friends from whom they can secure a large first and second mortgage at a fairly reasonable rate, others may be able to secure a first mortgage from some financing institution which will be an amount equal to one-half the total cost of land and house, and then they may be able to secure a second mortgage from some friend, for most business houses are not prone to take second mortgages. Often a greater sum can be raised on the contract system, for by this method the person lending the money is more certainly assured of securing quick control of it in case of the necessity of action when payments on the interest fail. By the contract method, the individual lending the money holds the deed of the property, and can secure control of the property more quickly than if he had a mortgage and the owner held the deed. In many cases where foreclosure of mortgages are found necessary, there may be a delay of a year or more before the money-lender can secure control of the property, but if he holds the deed, the delay is shortened, and because of this fact, he is apt to lend more money than 50 per cent of the total value. Of course in the contract method the owner secures the deed to the property when his last payment is made upon the principle and he has wiped out all of his interest indebtedness.

But probably one of the most satisfactory systems yet devised for financing the small house is through the various building and loan associations which have grown to great strength in this country. These associations not only offer investment opportunities for small investors but they make excellent and easy terms for those to whom they lend money for home-building. The arrangements with these institutions make the payments on mortgages almost like the payments in monthly rents, and yet at the same time the principle is continually being reduced, so that in about twelve years it is completely paid off. Then, too, one is assured of not being in the hands of some unscrupulous money-lender, as sometimes one discovers a friend to be, however trustworthy he may have seemed before this business relation developed.

These building loan associations will lend as high as 80 per cent on the value of house and grounds, provided the character of the individual in the community warrants it. Their average-size loans have been computed to be about $4,000. If the minimum payment is adhered to, the loan is usually paid up in twelve years, although arrangements can be made by which this can be shortened. The interest charged is from 6 per cent to 8 per cent.

If the money is not secured through the above source, then it is customary to pay a commission to the agent who secures a loan from some financing institution or private investor. This commission differs, according to the locality, ranging from 1 to 4 per cent on first mortgages, and from 5 per cent upward on second mortgages. If a contract is desired on a second mortgage, the agent will be obliged to secure it from some private individual, for first-mortgage companies will not purchase them. This often leads to discounts of from 15 to 30 per cent on second mortgages and contracts.

It is well for every prospective owner, before he considers financing the construction of a small house, to sit down and figure out all of the incidental expenditures which are connected with it, for often some of the minor items are not taken into account, and they may spoil the whole scheme. Taking a typical example, the items of expense are as follows:

1. Cost of the lot.
2. Fee for title search.
3. Tax search and recording fee.
4. Possibly cost of surveying lot, but not always.
5. Broker's fee for securing mortgage.
6. Interest on each advance of the loan during erection.
7. Cost of the building less the amount borrowed.
8. Architect's fee.
9. Owner's liability insurance.
10. Fee for filing plans in Building Department.

Cost To Be Met During Year of Ownership

1. Interest on building loan.
2. Payment on reduction of loan.
3. Interest lost on owner's money which he invested in the lot and building.
4. Fire insurance.
5. Upkeep, usually about 1½ per cent.
6. Taxes on property and water-supply.
7. Possible assessments.
8. Maintenance cost, such as coal, gas, and electricity.

The above list of expenses should be frankly faced in the beginning, tabulated, and duly considered by every prospective owner of the small house. There are some architects who for fear of discouraging their clients from building will not sit down with them and show them a plain statement of the money they will have to invest, and when all of these minor items begin to pop up during the progress of the operations, the client begins to lose confidence, wonders where the next unexpected bill will come from, and blames the architect for having misrepresented conditions to him. Any prospective owner who has to be blindfolded to the costs which he must meet in order to muster up courage to build ought to be left alone, for he will do the architect no good, but considerable harm. Individuals who have their castles in the air so high that they cannot reduce their dreams to dollars and cents before they begin, ought never to build. These are the kind that start the cry that it always costs more to build than one ever figured on in the beginning.

But coming back to the question of securing the building loan, it will be found that nearly all lenders will insist that

the owner put his money in first. That is, he must meet the first payments to the builder himself, until he has put in all of his share. The rest will then be taken up by the financing institution, but always enough will be held back to assure sufficient funds for the completion of the house and the payment of all bills. The lender generally states at what periods of the construction money will be passed over, and this schedule is generally adopted as the one for the periodic payments to the builder. Of course the contractor must be consulted on the matter, and his approval secured, but there will be little difficulty on this score, for he will recognize the power of the financing institution to dictate the dates of payment.

As to the matter of contracting for the construction of the small house, there is little doubt that for so small a building the method of securing one general contractor to assume the responsibility of the whole work is the best. There are many who believe in employing day labor, and hiring the services of a supervising builder. The cost is itemized and the contractor adds a percentage as his share. This insures better-class work, but in practically all cases it is more expensive, and no assurance can be had of the final cost.

When the plans are let out to various contractors for bids, there should be no obligation attached to them that the lowest bidder will secure the job. This is a protection, for the human element often enters into relations of this kind, and the lowest bidder may not be the most trustworthy personage, nor have the best reputation.

When the contract is finally let, there are a number of things which it should cover that are intended to protect the finances of the owner. For instance, the contractor should be required to maintain insurance that will protect him from the claims under workmen's compensation acts, and from any other claims for damages for personal injury, including death, which might arise from the operations of building. The owner should also maintain a similar liability insurance to protect himself.

The owner should carry a fire insurance on the entire building and materials to at least 80 per cent of the total value.

When there is doubt as to the financial strength of a contractor, he should be required to furnish a bond covering the faithful performance of the contract and the payment of all obligations.

Then, too, it is customary to set forth cash allowances in the specifications to cover certain items, like plumbing fixtures, hardware, and electric-light fixtures. The contractor should be made to declare that the contract sum includes these cash allowances.

Careful understanding with the contractor should be arranged as to the method by which he will be paid. Generally, as was previously stated, the financing institution has control over the schedule of payments, and once this is agreeable to the contractor, he should be required to submit to the architect an application for each payment with receipts and other vouchers, showing his payments for materials and labor, including payments to subcontractors, at least ten days before each payment falls due. It is the duty of the architect to determine the accuracy of each one of these applications for payment before he issues the certificate of payment for such amounts as he decides is properly due. There are some architects who make it a practice to hold back a certain percentage of the first payment, and continue this with every later payment, until the last, in order to have a club over the head of the contractor and also a factor of safety, lest the builder has rendered an application for payment in excess of the amount of labor and material delivered. This, of course, will cause hard feelings sometimes, and create friction between architect and contractor, a thing studiously to be avoided, and for this cause such procedure should be dropped when the architect knows the character of the contractor.

The architect should always reserve the right to withhold part or all of the certificate of payment when defective work is not remedied, or when any claims are filed, or there is reasonable evidence that claims will be filed, or when the contractor fails to make payments to subcontractors, or to dealers for materials, or when there is a reasonable doubt that the contract can be completed for the balance unpaid, or when any damage involving liabilities has been done by one contractor to another. The architect should also hold back the final payment if there are any liens existing against the building until they are removed.

In order to avoid many of the trivial and annoying expenses which occur in a building operation, the contractor should be required to pay for all permits and licenses (but not permanent easements) which are necessary according to local laws. The contractor should also be made to pay all royalties on patents, if there are any, and all license fees.

But, probably, the most difficult part of the building operation to finance are the extras. When something is found to have been omitted from the plans and specifications, and the contractor did not cover it in his bid, or when the owner changes his mind and requires an alteration, then this extra work must be paid for at a high rate, for nearly all contractors look upon such extras as good pickings. In fact there are some contractors who deliberately go over the plans and specifications to note what extras may be needed, and then counting upon their profits from these extras, they put in a low bid, so that they can beat their competitors, secure the job, and then proceed to make up their losses with bills which they put in for the extras. Likewise a contractor who is honest, if he finds himself losing money on any building operation, will try to ease his losses and gain profit with the extras.

There must, therefore, be some basis upon which estimates for these extras will be determined. The values for these extras or changes in the work may be determined by a submitted estimate and acceptance in a lump sum, by a unit price named in the contract or subsequently agreed upon, or by the cost and percentage, or by the fixed fee method. If the contractor claims that any instructions, by drawings or otherwise, involve extra cost under his contract, he should be required to give the architect written notice of it before proceeding to do the work, within two weeks after receiving such instructions.

A final problem of financing should be considered, and that is the emergency which might arise should the contractor neglect to prosecute the work properly or fail to perform any provision of his contract. If such is the case, the owner should reserve the right in the contract, that after three days' written notice to the contractor he may make good such deficiencies and deduct the cost from the payment due the contractor at that time. Of course every contract should provide for the owner's right to terminate the contract should the contractor fail to do his work, or prove bankrupt, or persistently disregard laws, or continually violate the provisions of the contract.

A Charming English-Style House

By Charles Alma Byers

THE English-style house is coming into much favor in this country, and, if well handled architecturally, it always makes a very attractive home. The little house of this style illustrated herewith is of exceptionally excellent design, both as to outside structural lines and in respect to interior planning. The roof, characterized by a steep pitch and a graceful sweep of long lines, is especially full of character, and the manner in which the front window bay is extended upward from the ground to the full height of the second story, to help provide room for the semi-winding staircase, lends particular charm to the front. Other delightful and enhancing features of the exterior are the open vestibule-like entrance porch on the front, the *porte-cochère* that provides complete protection to a side vestibuled entrance, and the two cement-paved terraces—one on a front corner and accessible from the living-room, and the other on a corner in the rear and accessible, through either French doors or French windows, from both the living-room and dining-room.

House, Mrs. Theodore Nelson, Los Angeles, Cal. Frederick J. Soper, Architect.

The house is mainly of frame construction, with the outside walls finished with light buff cement-stucco. Bright-red brickwork, however, is liberally represented about the entrance and in facing the front walls. The roof is of wood shingles, painted green, and all wood trimming is done in dark brown.

The arrangement of the interior will be observed from the accompanying floor plans. Particular notice should be taken of the large living-room, which reaches entirely across the front, and of the manner in which the staircase rises therefrom. The dining-room, it will be seen, is set sort of diagonally in the plan, and French doors connect it both with the dining-room and with a little breakfast-room, as well as with the rear terrace. On the first floor is, in addition to the other usual divisions, a conveniently located maid's room, with bath, and on the second floor are three bedrooms and two baths.

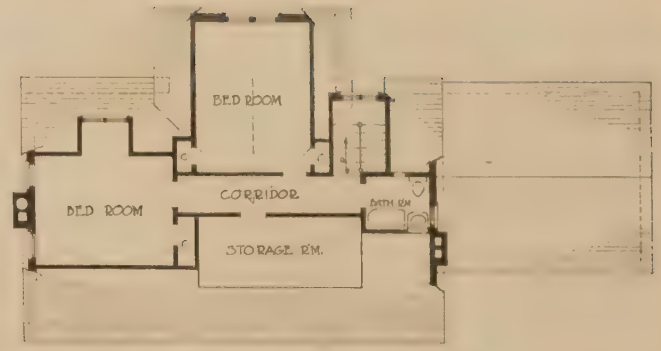
The closets and built-in features indicated in the plans particularly deserve notice. The closets, for instance, include a closet for wraps off one corner of the living-room, a broom-closet on the kitchen-entry porch, a little storage-closet in the kitchen, a clothes-closet for each of the bedrooms and for the maid's room, a large storage off one of the bedrooms, a large closet in the upstairs hall, and a linen-closet in each of the second-floor bathrooms and in the hall. The built-in features consist of china cupboards in the dining-room and breakfast-room, excellent cupboards and the other customary conveniences in the kitchen and pantry, and a medicine-case in each of the three bathrooms.

The interior woodwork consists of pine, finished in old ivory style, with mahogany trim, in the living-room and dining-room, and of pine alone, finished either in old ivory or white enamel, in all remaining divisions. The plastered walls of the living-room are given a hard finish and painted in oil, with stencilled decoration, and in the dining-room, breakfast-room, maid's room and the bedrooms they are papered. Hardwood floors prevail throughout, except in the bathrooms, kitchen, and kitchen-entry porch. The two second-floor bathrooms have tile floors, and their walls are finished with a four-foot tile wainscot.

The house has a large basement, reached by a stairway off the dining-room, and off the pantry there is a back stairway to the second floor. The equipment includes a furnace and all other modern conveniences. The house is located in Los Angeles, California, and was designed by Frederick J. Soper, architect, of that city.

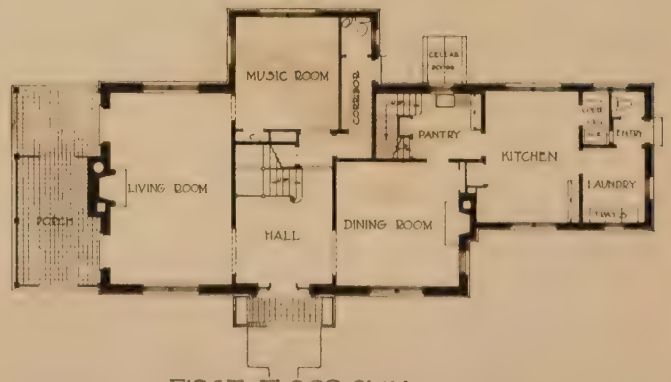
HOUSE, G. SHELDON CHAUNCEY, SOUTH ORANGE, N. J.
Edward Buehler Delk, Architect.

ENTRANCE DOORWAY.



THIRD FLOOR PLAN

SECOND FLOOR PLAN



FIRST FLOOR PLAN

HOUSE, G. SHELDON CHAUNCEY, SOUTH ORANGE, N. J.

Edward Buehler Delk, Architect.

How Austria Is Helping to Solve the Housing Problem

By Ella Briggs, Architect

THE need for dwellings, especially small ones, had become so urgent that the government had to do something. It tried, in a new law, to offer the following solution: country, state, and city are either to give out of their own means,

Housing development near Vienna. Layout for part of grounds.

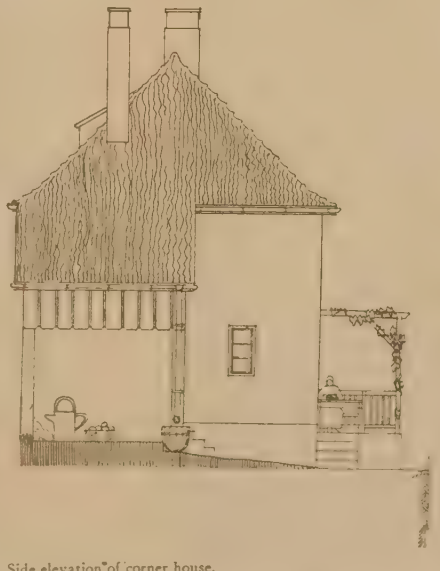
money on long terms for the building of small-sized homes, or else guarantee that a certain percentage, usually 6 per cent, is paid for the money lent by banks for the purpose of building small homes. The money plus interest is to be repaid by the owners on the long instalment plan.

The grounds are given out of public property on hereditary lease, usually for eighty years. After this time, land and the houses on it fall back to the public owner. To prevent the temporary owner from allowing the house to become dilapidated at the end of the leasehold, the Austrian law provides for paying back to him part of the appraised value of the house.

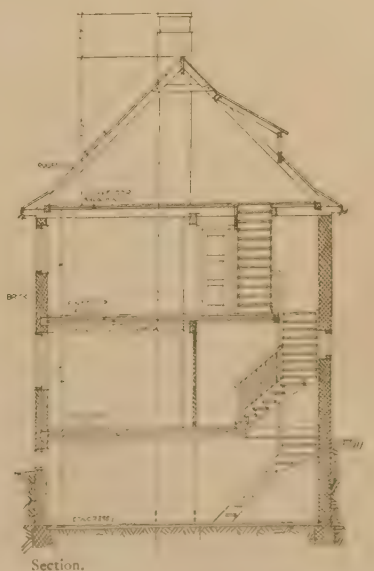
Most of these homes are built not as apartments but as family houses. Land not being scarce or as valuable in Vienna as it is in New York, it was found out that the building of small homes is not more expensive than that of apartments.

Let us look at one of these homes. The conditions for which it is meant differ widely from the American ones. They have one main room where the heat of the cooking-stove is utilized in an adjacent tiled stove. One of these kitchen and living-room combinations, though small, makes a most intimate and homelike impression. Adjoining the kitchen, there is a small scullery, where all the dirty household work is done. There stands the wash-tub and the bath-tub, which, in daytime, covered by a board, must serve as a table. Thoughtful architects will always provide for a door in the right place, or for a small window from the kitchen to the scullery to allow the housewife, while doing her work there, to peep at her cooking-pots. In building these homes, it is the aim of every architect to save the housewife every superfluous step, and by so doing, fill the first condition for the well-being of the family.

Outside the house a small stable and a small shed are provided for the farm work. Part of this is done separately in each garden and part of it in the common grounds. In fact, a main factor which made advisable the building of these houses is the truck-farming that the owners of these houses are doing on the grounds surrounding the home. The chief reason for the misery existing in Vienna is due to the fact that Austria does not produce nearly enough foodstuffs necessary for the maintenance of all its inhabitants. There are planned common fruit gardens as well as common potato acres. Each family has to work there a certain number of hours and in exchange for this work gets the part of the general crops allotted to it. The co-operative working scheme is applied in the building of these homes. The associations that have in hand the building usually prescribe to their members at least 1,500 working hours before they can own a home of their own. To develop the feeling for the community, to equalize men by making them work together, are some of the most prominent ideals of the Austrian housing development. Nevertheless, they who live there will never grow to be communists. The owning of personal property is the safest way to keep people from going into communistic excesses.

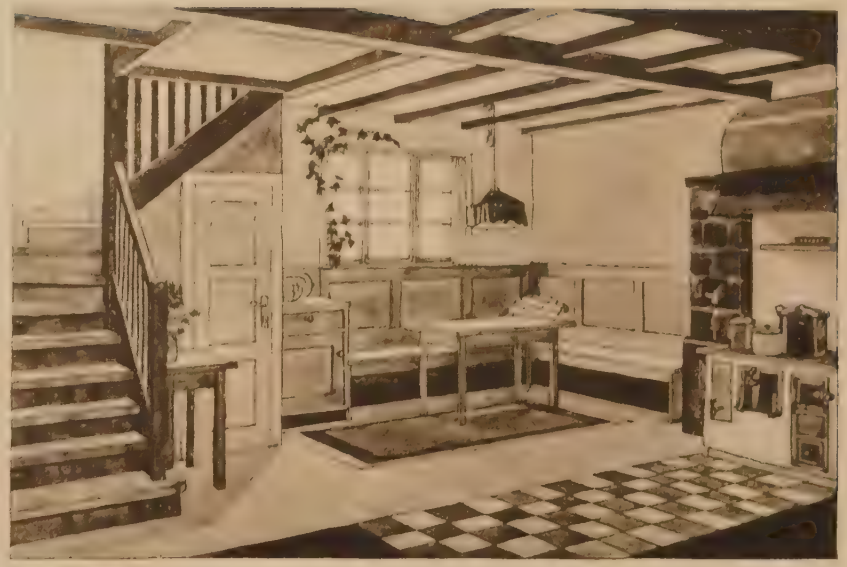


Side elevation of corner house.

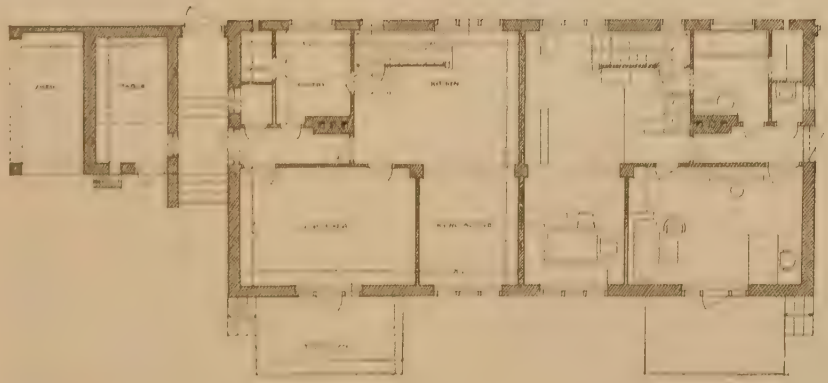


Section.

CORNER OR SEMI-DETACHED HOUSE.



INTERIOR.



FIRST FLOOR PLAN, SEMI DETACHED HOUSE.

SECOND-FLOOR PLAN, SEMI DETACHED HOUSE. Ella Briggs, Architect.

GOVERNMENT HOUSING DEVELOPMENT, VIENNA, AUSTRIA.

Drafting-Room Mathematics

By DeWitt Clinton Pond, M.A.

THE two most useful branches of mathematics used in the drafting-room, with the exception of plain arithmatic, are geometry and trigonometry. Of course, in the drafting-rooms of engineers this is not altogether true, as algebra, and the solving of problems by means of algebraic formulas, has an importance which cannot be exaggerated. Architects, and architectural draftsmen, however, do not have as much use for this type of work as they do for the kind of calculations which will enable them to determine distances and angles in case their problems are complicated by designing buildings to fit irregular lots.

Most of us have had a knowledge of these two branches of the science of mathematics drilled into us during the days of our school experiences. Unfortunately, at this time our instructors did not seem to have a keen appreciation of the truly practical value of either geometry or trigonometry, with the result that many of us did not carry into our practical work a lively remembrance of even the rudiments.

The most common experience of the architectural draftsman is to be presented with a survey of a plot with at least one side which is not at right angles to its adjacent sides. The survey may be complete, or it may be of a type with which the architect may be needlessly familiar, in which not all the angles are given, few elevations are noted, and other important information is lacking. This last characteristic is more particularly true of surveys made in cities where building operations are confined to smaller structures. In this case the architect or his draftsman must determine by means of his own calculations the required information.

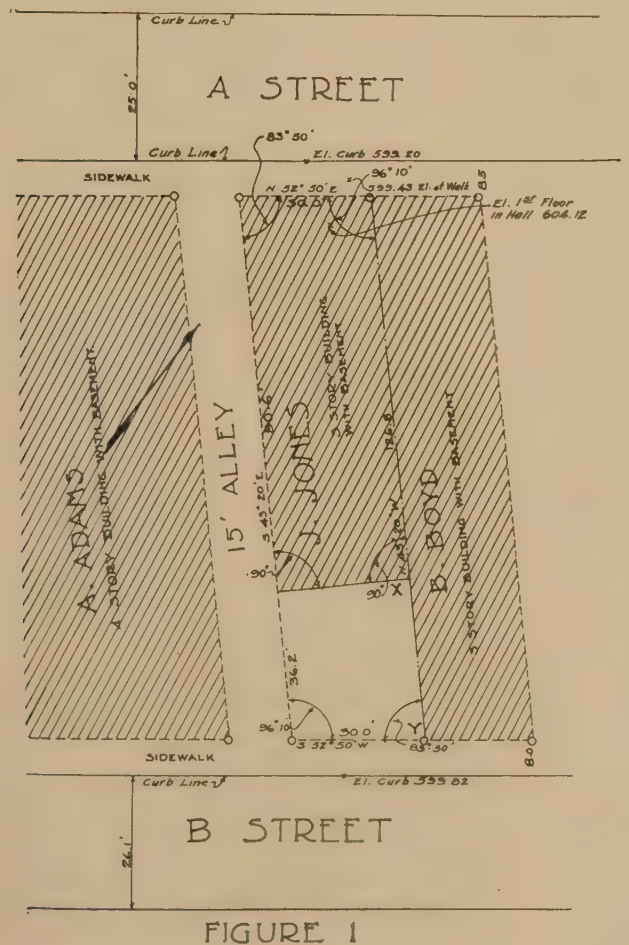


FIGURE 1

A survey which is fairly characteristic of the type which is submitted at least once or twice to every architect is shown in Fig. 1. This is not a theoretical problem but one encountered in actual practice. The names of streets and owners are assumed in this discussion. The problem presented to the architects was to draw plans and elevations for an addition to the building belonging to J. Jones which occupied part of the lot shown in the figure, the addition being planned to occupy the remaining part of the plot. It will be seen that the frontages on both A and B streets are each 30 feet, that the depth of the lot measured along the alley is 126.8 feet, and that the acute angles are given as 83 degrees and 50 minutes, and the obtuse angles as 96 degrees and 10 minutes. The lot is a parallelogram. An important dimension is not given. This is the dimension from a point, marked for convenience, X and a second point marked Y.

It would have been possible for the architect to demand that the owners furnish him with this dimension, but, as it was not a difficult problem for him to determine it himself from the information given in the survey, he did this without asking for further instructions.

In order to obtain the required dimension, as well as the distance across the lot measured perpendicularly to the alley, it was necessary for him to make use of his knowledge of trigonometry, which the dictionary defines as "mathematics treating of the relations between sides and angles of triangles."

For thousands of years it has been known that in a right triangle, such as shown in Fig. 2, there were certain constant relations which existed between the sides and the angles. No matter how long the sides of a right triangle may be the *relations* between them are always constant. It is known, for example, that if the base of a right triangle measures 1 inch and the upright leg measures 1 inch, that the angle opposite the upright leg will be 45 degrees. It does not make any difference if the length of each of the legs becomes 1 foot, or 1 mile, or any other distance; provided the same relation is maintained between them, the angle will remain 45 degrees. It is found that there are other interesting relations. It will be noticed in the triangle shown in Fig. 2 that the three angles are designated as A, B, and C, and that the sides opposite them are noted as a, b, and c respectively. Now it has been found that in a triangle similar to the one shown, if the angle A happened to be 30 degrees, the side a would always be one-half as large as the side c. Reasoning in the reverse direction, it became apparent that, no matter how long the sides were, if a were one-half of c the angle A would be 30 degrees.

It becomes evident that for any particular relation between the sides of a right triangle there will always be a definite angle. These relations—ratios—are tabulated and are known as trigonometric functions, and are given definite names. The relation determined by dividing a by c is known

as the sine. If the angle A is 30 degrees, the sine is one-half, and is noted in the table of trigonometric functions as .50000. The relation determined by dividing a by b is known as the tangent. If the angle is 45 degrees the tangent is 1, as a and b are equal.

In like manner other relations known as cosine, cotangent, secant, and cosecant are determined as are listed below.

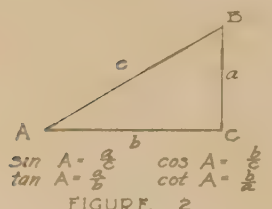


FIGURE 2

The relation determined by dividing the opposite side by the hypothenuse—a/c—is known as the sine, abbreviated as sin.

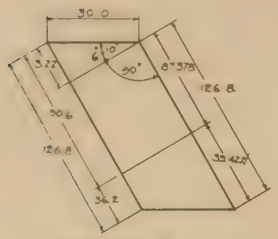


FIGURE 3

The relation determined by dividing the adjacent side by the hypothenuse—b/c—is known as the cosine, abbreviated as cos.

The relation determined by dividing the opposite side by the adjacent side—a/b—is known as the tangent, abbreviated as tan.

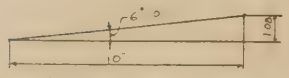


FIGURE 4

The relation determined by dividing the adjacent side by the opposite side—b/a—is known as the cotangent, abbreviated as cot.

The relation determined by dividing the hypothenuse by the opposite side—c/b—is known as the secant, abbreviated as sec.

The relation determined by dividing the hypothenuse by the adjacent side—c/a—is known as the cosecant, abbreviated as csc.

It is apparent that, if we know a side and an angle, other than the right angle, in such a triangle as shown in Fig. 2, it is possible to find either one of the other two sides or the remaining angle. Assuming that A is 30 degrees, and a is 10 feet, it is not very difficult to determine that c is 20 feet. If this were determined in the manner common to such calculations, the figures would be set down as follows:

$$csc\ A = c/a = 2.0000$$
$$c = csc\ A \times a$$
$$a = 10 \text{ feet}$$
$$c = 2.000 \times 10 = 20 \text{ feet}$$

In the calculations the cosecant was used, but under ordinary circumstances engineers do not make much use of this function. Those which are commonly used are the sine, cosine, tangent, and cotangent. In order to obtain the result found above by the use of the sine, it would have simply been necessary to divide a by the sine of A.

$$10 \div .5000 = 20$$

The functions of all angles are given in tables some of which are more accurate than others, and are carried out to six places beyond the decimal point. The tables which will be used with these calculations are carried to only four places beyond the decimal point, but they will be accurate enough for the purpose of showing the methods employed.

In Fig. 3 the conditions encountered in the survey as shown in Fig. 1 are presented diagrammatically with the angles exaggerated in order to make the problem clearer. It is always a good plan to draw such a diagram in solving a problem of this kind. In order to find the distance from X to Y, it is necessary first to find the distance, measured along the lot line, from A Street to the point X. It is known that the side of the building along the alley measures 90.6 feet, and that the rear wall of the building is built at a right angle to the alley. If a right triangle is drawn with the angle A at the intersection of the lot line and A Street, and the length of the side a is determined, it will be possible to find the distance from the intersection of the lot line and A Street to the point X by subtracting the length of a from 90.6 feet.

In the right triangle we know that the hypothenuse measures 30 feet, and that the angle at A is 6 degrees 10 minutes. The next step is to determine the sine and cosine of this angle which can be found in a table of natural trigonometric functions. The sine is .1074 and the cosine is .9942. These values can be checked by the reader if he refers to a book of tables or even to a Cambria or Carnegie handbook, in which tables will be found.

Now the sine is obtained by dividing the side opposite the angle by the hypothenuse, and it is apparent that if the sine is multiplied by the hypothenuse the result will be the length of the opposite side. This can be seen if the calculations given below are understood.

$$sin\ A = a/c$$
$$a/c \times c = a$$
$$sin\ A \times c = a$$

In the same manner, the cosine is obtained by dividing the adjacent side by the hypothenuse, and if the cosine is multiplied by the hypothenuse the result will be the length of the adjacent side, or the base of the triangle.

$$cos\ A = b/c$$
$$b/c \times c = b$$
$$cos\ A \times c = b$$

The next step is to make use of these values in the problem under consideration. The hypothenuse is equal to 30 feet and the sine has a value of .1074, so it is only necessary to multiply these two quantities to obtain the length of the side opposite the angle A.

$$.1074 \times 30 = 3.222 \text{ feet}$$

By referring to a table of decimal equivalents in any handbook the dimension of 3 feet $2\frac{1}{16}$ inches will be found to be the nearest to the decimal given above, which will be of practical value. Of course, even a sixteenth of an inch will be extremely difficult to measure in the length of a building, but in order to make the dimensions on the plans check, this value of 3 feet $2\frac{1}{16}$ inches will be used.

It is not always safe to use the fractions which are the nearest equivalent to the decimals if several calculations are involved, as an error is apt to result from the changing from one system of dimensions to the other.

By subtracting 3.222 feet from 90.6 feet the dimension of 87.378 is obtained, and by subtracting this from 126.8 feet it is possible to find that the wall along the lot line of the new addition will measure 39.422 feet, or 39 feet $5\frac{1}{16}$ inches.

This is an important dimension and must be placed on the plan. This explanation of the method used to obtain the dimension has taken so much space that it would seem

as if it were a complicated problem. Actually it is very simple, and the figures involved would take but little space on the architect's sheet of calculations.

The other dimension, which it is important for the architect to know, is the distance across the building measured perpendicularly to the alley or lot line. This is obtained by using the cosine of the angle *A*, for this dimension will be the length of the base of the right triangle. The cosine was found to be .9942.

$$.9942 \times 30 = 29.826$$

This dimension will be placed on the plans as 29 feet 9⅞ inches.

This problem is a comparatively simple one, as the plot is a parallelogram and only one angle is involved. There are cases, however, where the plots have no particular shape and where the introduction of a court in a plan adds further complications. When such conditions confront the architect or engineer, he seldom uses the natural functions of the angles but the logarithms of these functions. An explanation of the use of logarithms will be taken up in a following article.

If the reader is not particularly familiar with the use of trigonometric functions it would be profitable for him to originate problems of his own in which he can assume right triangles with the dimension of one side known and one angle. By the use of the tables he can determine the length of the other side, and in order to check the result he can make use of the geometric proposition that the square of the hypothenuse of a right triangle is equal to the sum of the squares of the other two sides.

As the natural functions of angles are under discussion it might be well to make a note of the fact that the tangent of an angle can be used by the draftsman in laying out the angle in case he does not have a protractor available. The tangent of an angle is obtained by dividing the side of a right triangle adjacent to the angle by the opposite side. It is obvious, therefore, that if the tangent is multiplied by the adjacent side the result will be the dimension of the opposite side.

$$\tan A = a/b$$
$$a/b \times b = a$$
$$\tan A \times b = a$$

In case it were desirable to lay out the angle of 6 degrees 10 minutes, it is only necessary to use as a base of a right triangle a line which, for convenience, is made 10 inches long. The upright leg can be found by multiplying the tangent of 6 degrees 10 minutes, or .1080, by 10. The result will equal 1.08 inches, and if a point is found on a line perpendicular to the 10-inch line and at one end of it, and a third line is drawn through this point and the other end of the base-line, the angle which is made will be 6 degrees 10 minutes. This is shown diagrammatically in Fig. 4.

Announcements

The "Bungalow Beautiful" Show Place at Atlantic City Has Interior Trim of Genuine Figured Mahogany.—The Mahogany Association kept a careful cost-sheet on all the mahogany used in the bungalow, and also received estimates on other kinds of cabinet woods. The results are somewhat surprising. The cost of all the interior woodwork, in which are included window-casings, doors, built-in bookcases, mantel baseboards, mouldings, etc., was $880. According to the bids received, quartered oak would have cost $822; plain oak would have cost $810; birch, stained, would have cost $810; and poplar, stained, would have cost $800. In other words, the cost of installing figured mahogany trim on the entire job was only $80 more than the lowest-priced cabinet wood.

The Venus Everpointed, the perfected metal pencil manufactured by the American Lead Pencil Company, has a simplified mechanism. Its action is, consequently, both sure and permanent. Another improvement with the Venus Everpointed is that the refill leads are simply and easily inserted from the front, a year's supply being contained in the tube within the pencil head.

A new 44-page catalogue, No. 295, on air-washers, has just been published by the B. F. Sturtevant Company, of Hyde Park, Boston, Mass. It is profusely illustrated and shows the various details of construction by which the air for any building, or for any industry, is thoroughly washed and tempered before entering the building. The motors and pumps are also described and illustrated. Installations are shown in a city hall, a chocolate factory, a customs house, a theatre, as well as other types of buildings. A copy of this catalogue will be forwarded on request.

Scheid Engineering Corporation, 90 West Street, New York City, has been appointed metropolitan and export representative for the Franklin Moore Company, Winsted, Connecticut, manufacturers of material handling machinery for industrial plants.

We acknowledge the receipt of the following recent catalogues:

"Ivanhoe Brown and Pressed Design Ornamental Glassware," The Ivanhoe Regent Works of General Electric Co., Cleveland, Ohio.

"Marks System of Gypsum Roofs—Poured-in-Place—Pre-Cast Slabs," H. E. Marks Corporation, Cleveland, Ohio.

"Appalachian Tennessee Marble," Appalachian Marble Co., Knoxville, Tenn.

The booklet of the Monarch Metals Products Company, St. Louis, incorporates all the suggestions and recommendations made by the Structural Service Committee of the A. I. A., and is a direct result of the opinions expressed at a joint conference November 10, 1921, at Indianapolis, between the A. I. A. and the material manufacturers for better advertising. It has been prepared without any exaggerated claims for the product or superlatives in sales argument of its advantages.

The Utica Heater Company's Public Building Bulletin contains information regarding their Economic Super-Smokeless Boilers of value to architects.

The Lupton Steel Windows Catalogue No. 110 is exceptionally well arranged and illustrated, and should be a valuable reference for the architect.

THE BUSH BUILDING AND TIMES BUILDING, NEW YORK.

Integral Waterproofing: A Practical Discussion

(*Continued from October, 1922*)

By Samuel R. T. Very, Architect

THE tempering water was ordinary "Croton" water as drawn from the faucet in the New York testing laboratory, just such water as a mason would use on any ordinary New York building operation, shockingly unfiltered! And no doubt chock-full of unscientific conditions which would horrify the gentlemen who commonly perform tests similar to these. No particular overcare was used to measure with scientific accuracy ideal quantities for ideal results, but the manufacturer's requirements were nevertheless followed as rigidly as by the ordinary practical workman. Quantities used in each case were recorded merely as a matter of interest, not for scientific deduction, but the measures, gauges, scales, and other instruments used were scrupulously cleaned after each operation, and drawings, photographs, and careful descriptions of each were kept. As the object of this paper is not scientific, however, other such details will be omitted.

The samples of cement and waterproofing compounds were delivered in well-protected packages, were typical of job deliveries, were in perfect condition, and new. The quantities used were insignificant compared with their bulk as received. Before any mixture was made, the writer interviewed carefully the representatives of all of the manufacturers whose courtesy encouraged the tests, and here should be stated that almost universal and enthusiastic response was received from his request for co-operation. Their specific instructions were reviewed in their presence, as by a mason foreman receiving his initial instructions, and later were followed as rigidly as any job conditions would approximate.

To assure more or less comparative results, the same "work" was attempted in the mixing and tamping of each of the different specimens. The same tamping instrument was used for all of the specimens; it was a long cylindrical glass bottle, with a flat, circular, metallic screw-top. It was filled with sand until its weight was just one pound, then inverted, and dropped from a height of about an inch upon the pat within the ring (see photograph No. F. 91). No other person than the writer was present during the mixing, thus assuring the same "personal equation" for all the specimens. Each ring was numbered with a removable tag, which, months later, just before the testing, was each removed in the presence of all of the witnesses to the tests; and at that time, new, entirely different designating letters were marked directly upon the specimens themselves, the changes being accurately recorded and witnessed by all, without anybody present, not even the writer himself, having the slightest idea of the identity of a single specimen. Therefore, unlike the usual laboratory test, no results were being anticipated.

Great batches of dry cement and sand, many times the needed quantities, were thoroughly mixed uniformly in the quantities of 1 to 3, and the amounts necessary for specimens identical in their matrix were chosen from the same homogeneous batch (except in certain instances to be mentioned). The large superfluous balance was immediately discarded.

Seven specimens using white portland cement and white sand from the same batch were tempered and set May 3, 1914. Seven specimens using gray portland cement and white sand from the same mixed batch were tempered and set July 27. The specimens remaining, using, respectively, Rosendale cement, gray portland cement, and white portland cement, were mixed with different sands, and were tempered and set July 27 and July 28. Thick, soaked blotting-papers, themselves protected so as to evaporate slowly, were used to cover the rings without touching them, and they were allowed to dry very slowly by ordinary evaporation. The specimens were otherwise unmolested until the middle of August, the same year, when they were carefully wrapped in paper, and kept so until March, the following year, when they were unwrapped, and all placed together in a large bucket filled with water in which they remained submerged one day.

The next day, in the presence of representatives of all of the manufacturers concerned, who accepted the invitation, these specimens were remarked, as above stated, in such a manner that their cement and their waterproofing ingredients were both blind to all present, and they were tested carefully in a special hydraulic testing-machine, illustrated in photograph No. F. 91. Its construction is such that water may be forced through the whole area of a specimen without leakage about the ring circumference. Its pressure gauge is calibrated to 150 pounds per square inch of surface tested, but the pressure chosen for these tests was only two-thirds that capacity. This testing-machine is extremely simple to use with accuracy. Permeability only (as distinguished from absorption) was measured by observing the number of cubic centimetres of water forced through the specimen at a constant pressure during like periods of time (three minutes). Each reading was witnessed and approved by all the observers present, none having the slightest idea what specimen was being tested until the reading was recorded. The first experiment began at ten o'clock in the morning; the last ended at six o'clock in the afternoon of the same day.

There was not a single specimen tested which did not show porosity to some extent; but it should be noted that the pressure used was far greater than most field or job requirements. Some specimens showed porosity markedly more than others; some showed structural weaknesses, developed, no doubt, from the tremendous pressure used, which approximated a head of water 200 feet in height. Two specimens blew up, probably from inherent weakness not due in any way to the waterproofing compounds. One of these is illustrated (see specimen BB, photograph No. F. 87). There was not a single "unwaterproofed" specimen of the six tested that proved the equal of the best of the waterproofed specimens; but one of the six, specimen "S," photograph No. F. 89, which contained gray portland cement and ordinary Cow Bay sand only, tied for third place out of the whole lot with a waterproofed specimen mixed in identical proportions, 1 to 3, with white portland cement and white sand. The best of all showed absorption of only 1¾ cubic centimetres. This was waterproofed with a compound mixed with white portland cement and white Ottawa laboratory-testing sand, and is specimen "G," illustrated in photograph No. F. 86. The second best, not illustrated,

was mixed with another compound. The poorest of all, specimen "Z," photograph No. F. 90, with the exception of the two which burst, and some others, referred to later, was, strangely enough, of identically the same consistency as the best untreated specimen already mentioned (specimen "S"). It absorbed 21½ cubic centimetres of water. To all superficial appearances this less-waterproofed specimen is even more perfect than its mate which absorbed but 4½ cubic centimetres of water; it was mixed the same day, with the same ingredients taken from the same packages, but not mixed dry in the same batch. It was tempered with slightly more water, but was tamped the same number of times. This observation illustrates well the writer's opinion that unwaterproofed portland-cement mortar is largely dependent for its waterproof properties upon the variable personal equation of the men mixing or placing the batch.

While permeability was the sole experimental quest in these tests, the specimens show other interesting characteristics. Four of the waterproofed specimens showed, when wet, cracks invisible when dry. Their waterproofing compounds were, respectively, a paste, a liquid, and two powders, which divide the glory impartially amongst all classes tested. The two specimens which burst probably succumbed to too great pressure for their structural efficiency rather than to any deleterious effect from their waterproofing ingredient, which was in both cases the same as the compound which proved to be the most effective one recorded.

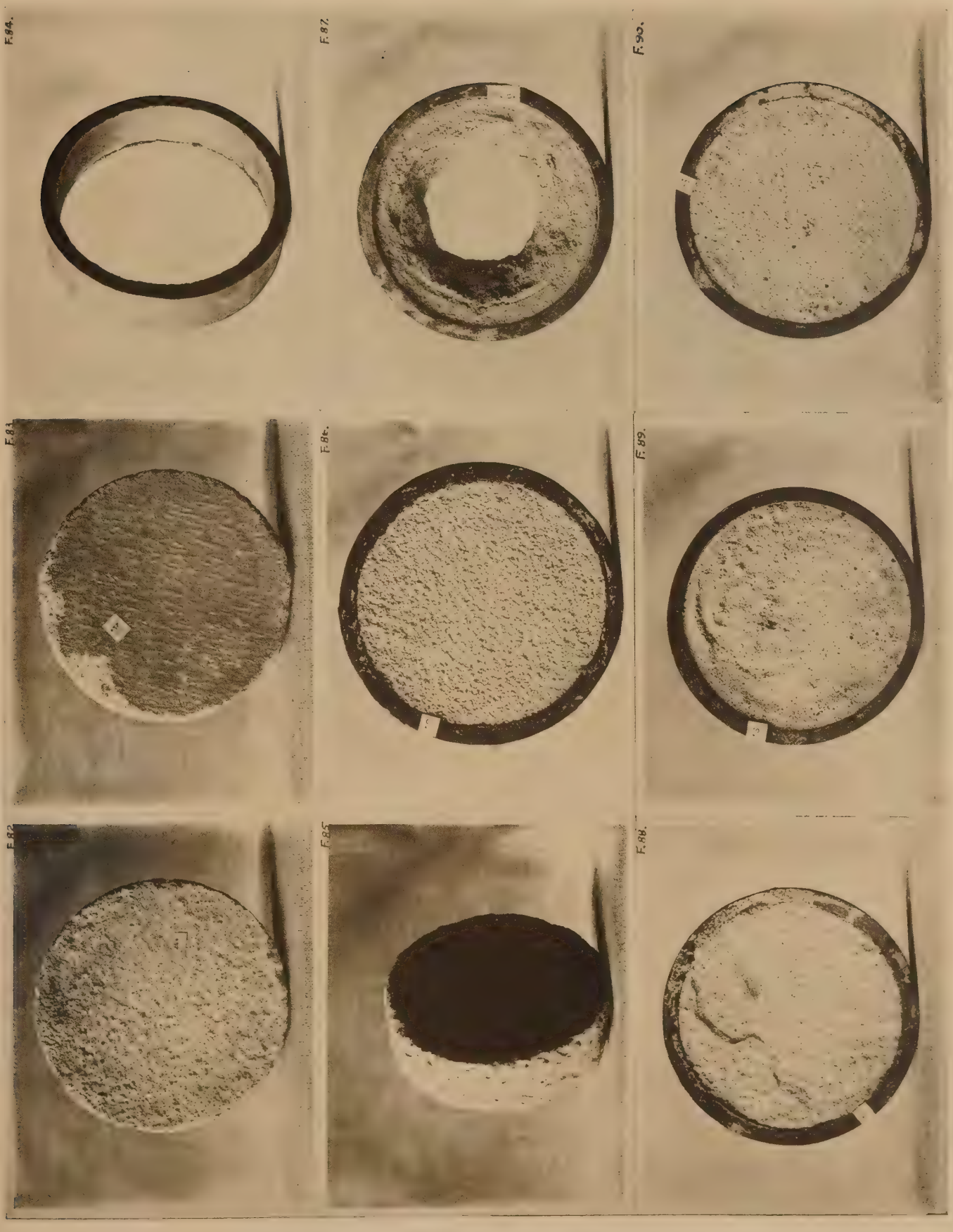
One of the specimens which cracked is illustrated by photograph No. F. 88 of specimen "D." It distinctly shows a considerable defective area. This specimen showed a pronounced tendency to scale; its laminated structure was undoubtedly due to the peculiar action of the particular liquid compound used for its waterproofing; the other ingredients in this specimen were the same as those used in the best specimen, "G" (photograph No. F. 86), and from the same batch of dry mixture, viz., white portland cement and white Ottawa laboratory-testing sand. This same liquid waterproofing compound was used in two other specimens, both of which developed marked permeability. The cement in each was gray portland, and was mixed in one case with white Ottawa sand and in the other with Cow Bay sand. In each of these instances it is the writer's conviction that the failure of the liquid to waterproof occurred not from its ineffectiveness as a waterproofing compound, but from its acting in some manner such that laminations developed in the setting specimen, which proved structurally weak at the tremendous pressure tested; this liquid may possibly be a good waterproofing compound at ordinary pressures.

Photographs Nos. F. 82, F. 83, and F. 85 show the obverse, reverse, and edge views of a single specimen, "A," mixed with white portland cement, and white Ottawa sand without waterproofing. It was mixed from the same batch as was specimen "G" (photograph No. F. 86). It very clearly shows a porous nature, notwithstanding the work done in the kneading process of tamping twenty times with the tamping bottle, and scraping off the superfluous mortar with three strokes of the trowel. It is honeycombed with voids which some sort of waterproofing compound might tend to lessen in number or decrease in size, in which event it would be interesting to learn if it were thus made less porous or more waterproof.

The writer did remove specimen "G" from its ring, and examined its circumference; photograph No. F. 92 shows the remarkable result. The near, right-hand specimen is specimen "G," the waterproofed specimen; the far, left-hand specimen, more honeycombed, is specimen "A," unwaterproofed; the same specimen as that photographed in Nos. F. 82, F. 83, and F. 85. The waterproofing compound used apparently tended to increase the ease of manipulation of the plastic mass, and as a direct consequence there was a decrease in size of the normal size of the voids; the cement was aided by the waterproofing compound to help itself as a void-filler. But lest the reader draws a very wrong conclusion from that part of the experiment, it is well here to correct some common misunderstandings. Voids in concrete masses frequently occupy one-fifth of the entire volume of the mass. These voids are sometimes interconnected, and in so far as they are so, they may form ducts which could permit the passage of water through them, but great caution should be used in drawing such a conclusion. Blotting-paper is porous; it contains voids; the volume of these voids exceeds the volume of the voids in the least dense masses of concrete; these voids are also interconnected, and they undoubtedly form ducts; but a tumbler of water, filled, and inverted upon a saturated piece of the most porous of blotting-paper will not leak out through it, not even when held freely suspended in the air. For the actual transmission of water through concrete some other medium than mere air-cavities is necessary. A tumbler full of air, inverted in water, will not fill with water, although it is just one huge void, apparently quite free to permit the passage of water.

In the zealous efforts of some opponents to discredit the claims for integral waterproofing compound advantages, they have strangely distorted the issues which these simple tests have served to clarify to the writer. The issues have nothing to do with tensile or compressive strength. Waterproofing compounds are not intended to increase the structural pressure resistance of cement mixtures. They are not even intended to increase the theoretical waterproofing efficiency of unwaterproofed stuccos over the practical least efficiency of treated stuccos; or to state it in a different way, they are not commercially intended to raise the laboratory-waterproofing efficiency of cement or concrete briquets. They are not theoretically intended to increase the density of the stone aggregate in concrete nor to lessen its natural absorption, except on or near its surface. They are not intended to bodily automatically replace the honeycomb voids of ill-mixed, ill-placed, badly proportioned concrete. They are not intended to act as a panacea for all waterproofing ills. They cannot convert ignorance into knowledge, and they will not change inefficiency into skill. Neither will they ruin the commercial profit of portland-cement manufacturers, who, if they only knew it, would have much better friends amongst some architects and some clients if their product could be used with the greater safety which their co-operation with, instead of antagonism to, manufacturers of good integral waterproofing compounds would warrant; there is nothing chemically deleterious to portland cement from many of these compounds, nor are they in any sense competitors of portland cement. They do, however, partly lessen the importance of the personal equation of cement-workers, who must, when using them, pay more attention to proper grading, mixing, tempering, and placing of concrete and stucco batches. They undoubtedly do bodily replace some of the imperceptible pores in even the best field specimens (there is a loss of approximately 7 per cent by weight of water evaporation from a theoretically perfect density of mix). They increase the colloidal efficiency of cement. They act somewhat as catalyzers, and cause a decrease in the normal number and natural size of the honeycomb voids; they help the mixture

(*Continued on page 360*)


F.84.
F.87.
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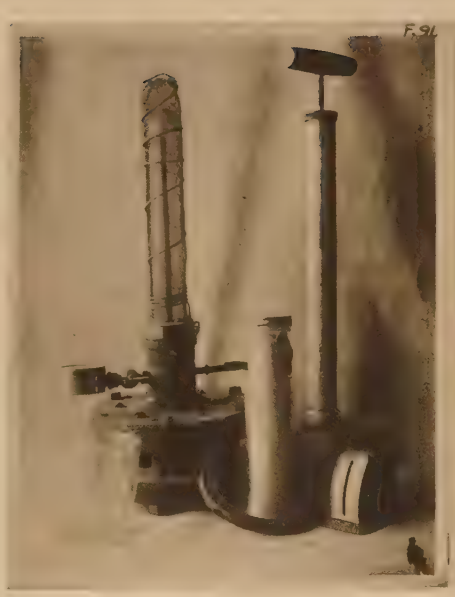
(*Continued from page 358*)

to densify itself. Some of them decrease and some abolish the capillarity of concrete and cement stuccos.



And unless the writer is mistaken, they will be eventually the cause of a tremendous increase in the architectural specification of cement stucco, now often justly feared, and even dreaded, by clients who prefer other materials known to be free from the common, obvious, and prevalent faults of unwaterproofed cement work. The United States Department of Agriculture got on record as long ago as 1915 saying "no amount of care in the preparation of concrete prevents the absorption of water into the mass. The addition of some water-repelling compound appears absolutely necessary to insure this result."

This article is purposed to rouse persons interested in the discussion of integral cement waterproofing compounds to a realization of a few of the fallacies sponsored by champions of all of the current opposing claims. It has accomplished a mighty service if it has cleared away the cataract from a single biassed eye; but if by lucky chance the cataract was upon the scientific eye of one of those mischievous, theoretical, laboratory cement-testing experimenters who have promulgated and spread the false notion that cement waterproofing compounds are useless just because it is theoretically possible to make cement mixtures impermeable without them; or if by luckier chance it was blinding the avaricious eye of a manufacturer more interested in the sale of his waterproofing product than in the advancement of its merits by scrupulous adherence to fact, its service has been colossal. There is no doubt that the latter class has done more harm to the engineering advancement of integral waterproofing than the former, who at least have nothing to gain by their antagonism; indeed, they have much to lose. Conservative architects would rather take a chance with old-fashioned methods which sometimes prove efficient than with "panaceas" for their occasional faults, commercially exploited by exaggerated claims which can easily be disproven.

But there is no doubt in the mind of the writer that some of the practical disadvantages from lack of integral waterproofing such as stucco-staining, discoloration, disintegration from frost and weather, and development of hair-cracks, and also many ills from dampness due to subsurface drainage, and seepage through unwaterproofed foundations, such as mildew of food-products and other stores, bacterial disease culture environment, and metallic disintegration, can be materially lessened, and even abolished, by the proper selection and intelligent use of a suitable waterproofing compound. This claim is broad. It sounds a little visionary, possibly as theoretical as the claim of a cement manufacturer's advertisement: "Concrete when properly made is water-tight"—of course it is *when* . . . ! But the writer's simple tests have made one convert to faith in waterproofing compounds.

Announcements

We are pleased to acknowledge the receipt of a copy of the new Lupton Catalogue No. 110, describing their steel windows for all classes of buildings. The chapter on residence windows is new. The matter in the other chapters is a condensed form of that in the No. 11 Catalogue.

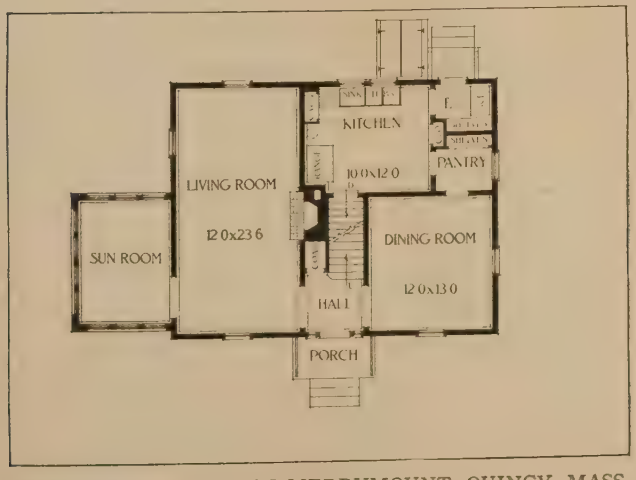
S. E. Holmes and C. B. Anthony announce the dissolution of the former partnership, Hatton, Holmes & Anthony, and that they have formed a new partnership under the name of Holmes–Anthony, architects and engineers. They will continue their practice in Rooms 307–308 O. R. C. Building, Cedar Rapids, Iowa.

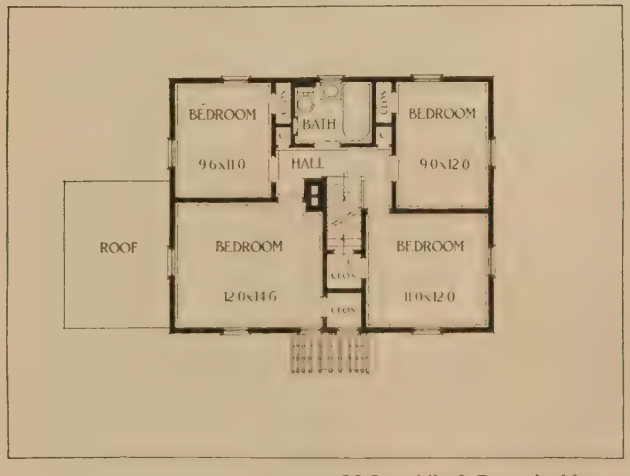
Economy Fuse and Mfg. Company has removed its Detroit, Michigan, sales office from 1012 Majestic Building to 1528 First National Bank Building.

The Atlantic Terra Cotta Company's series of illustrated monographs on famous Italian buildings, with photographs and measured details, make a valuable addition to the architect's reference library.

Announcement is made that G. Buller Colthurst, of the architectural firm of Nichols, Sheppard & Colthurst, 15 Sandwich Street, W., Windsor, Ontario, has withdrawn from the existing partnership, and will in future practise by himself at 32 Sandwich Street, W., Windsor. The present firm, under the name of Nichols & Sheppard, will continue to practise as usual at the old address.

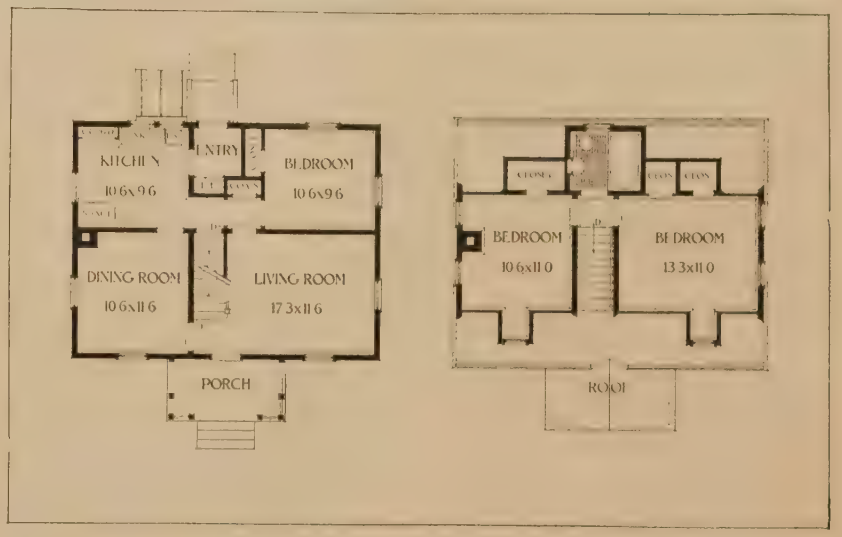
Felix Rasulo announces his removal from Proctor Building to 188 Linden Street, also that catalogues and literature are appreciated.





SEVEN-ROOM HOUSE AT MERRYMOUNT, QUINCY, MASS. McLaughlin & Burr, Architects.

Developed in gray-painted shingles, with white trim, bottle-green blinds, and a red roof.



SIX-ROOM HOUSE, WITH THREE EXTERIORS, AT QUINCY, MASS.

McLaughlin & Burr, Architects.

One in red brick, one in white clapboard, one in weathered shingles.

ARCHITECTVRE

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